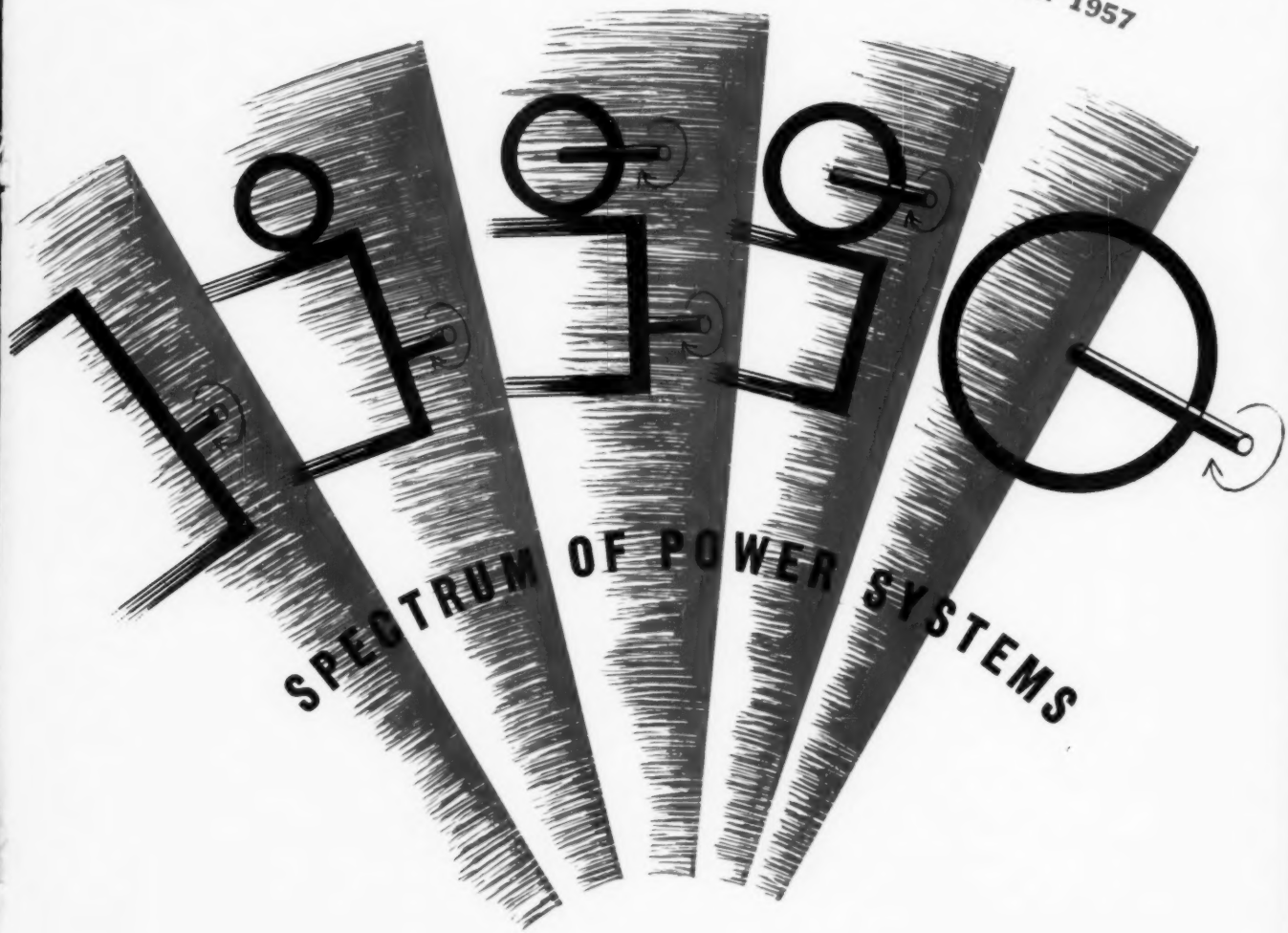
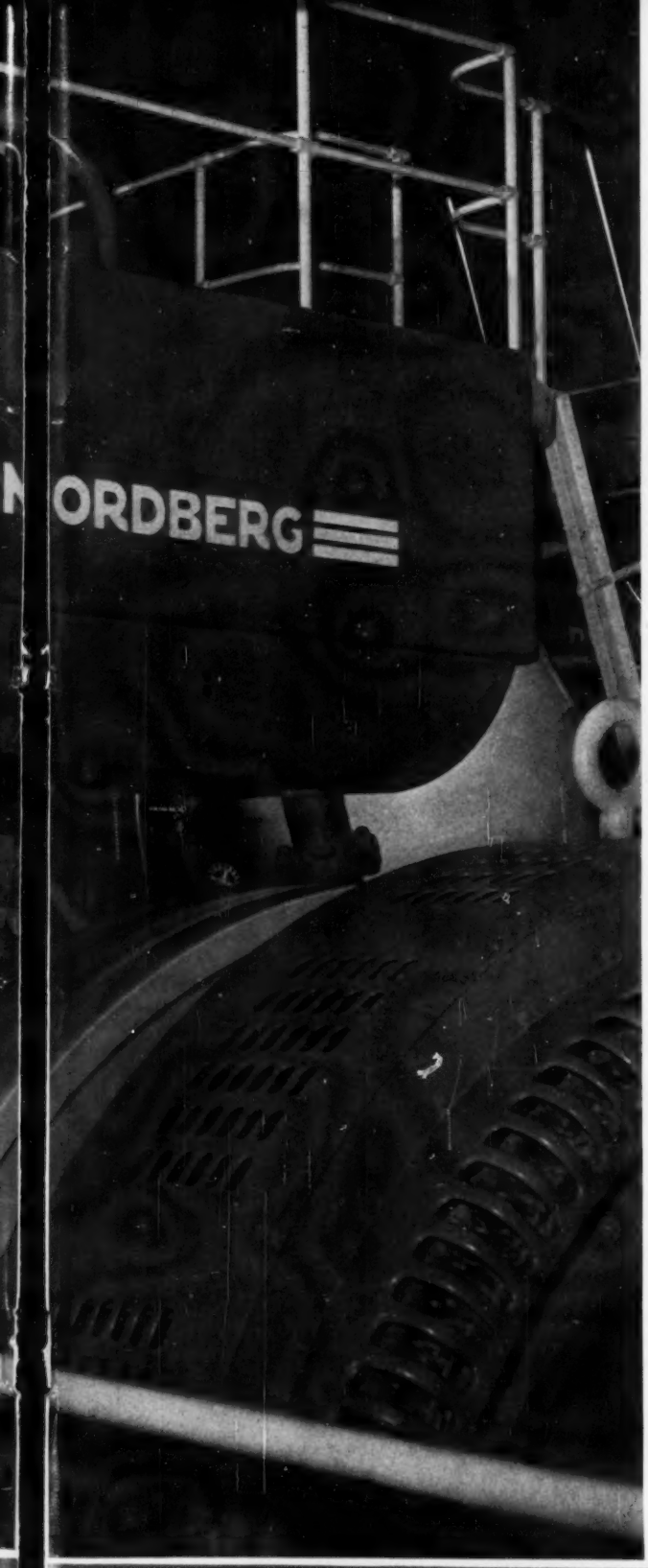
diesel power

November 1957



NORDBERG
TEXACO
TEXACO
REG. T.M.



Make sure you get the power you pay for

When fuel and maintenance bills get out of hand and power's not up to par, chances are your oil is the culprit. Let your Texaco Lubrication Engineer recommend the proper grade of *Texaco Ursa Oil.*

Texaco Ursa Oils keep diesel systems running clean for full compression and complete combustion . . . prevent harmful deposits in the combustion chamber, in crankcase and on valves. They help minimize ring, cylinder and bearing wear—all of which adds up to full power on less fuel and lower maintenance costs.

For over twenty years more stationary diesel horsepower in the United States has been lubricated with Texaco than with any other brand.

There is a complete line of *Texaco Ursa Oils* to meet the requirements of all diesel, gas and dual-fuel engines.

Just call the nearest of more than 2,000 Texaco Distributing Plants in the 48 States—or write The Texas Company, 135 East 42nd Streeet, New York 17, N. Y.

URSA OILS FOR ALL DIESEL, GAS AND DUAL-FUEL ENGINES

How Allis-Chalmers engines bring out the best in any equipment

YOUR EQUIPMENT DOES MORE when powered by Allis-Chalmers high-torque, high-usable-horsepower engines. There is a minimum of pull down due to sudden loads, with quick recovery of engine speed — and real lugging power at slow speeds.

KEEPS WORKING DAY AFTER DAY. There is unusual simplicity in rugged Allis-Chalmers engines. Diesel models, for instance, have 30 to 50 percent fewer wearing parts than competitive engines. Less can go wrong when parts are fewer and stronger.

GETS BACK TO WORK FASTER. Simplicity means easier servicing, too, for Allis-Chalmers engines. They are back to work quickly because you are close to fast parts and service, wherever you are.

See your Allis-Chalmers dealer for full information on engines that will get the most out of *your* equipment — *any* type or size, 9 to 516 hp; *any* fuel, LP or natural gas, gasoline or diesel; for *any* application. Allis-Chalmers, Buda Division, Milwaukee 1, Wisconsin.

BC-10

ALLIS-CHALMERS *Engineering in Action*

ROUTINE or EMERGENCY

There's a WOODWARD SERVICE PLAN to meet your requirements

Woodward service assures proper installation of all the latest improvements. Our experienced personnel have at their disposal the very finest tools, testing equipment and special plant facilities to rebuild any Woodward governor in a minimum of time.

Very often, due to the addition of latest improvements, your rebuilt unit will outperform the same governor when it was new.
A new governor guarantee covers work done in our plants.

Here are four ways to have your governor put in "like new" condition.

1. REPAIR AND RETURN
While your engine is shut down for other work, send the governor to our Rockford, Illinois, plant. List the governor serial number on your purchase order and make sure your company name is on the crate. Give shipping instructions and be sure to tell us when you want it back.

2. GOVERNOR EXCHANGE
Tell us when you intend to make the installation. We'll ship a governor like yours but with all the latest improvements. You can quickly install the new unit. Send the old governor to us. The cost — round trip shipping plus time and material to overhaul your old governor for our exchange stock.

3. EMERGENCY SERVICE
For real emergencies we'll send a man to your plant, with a governor if necessary. Our fleet of airplanes is ready to rush men and material to cope with the situation. Rare but very real emergencies usually can be handled in one day or less.

4. YOUR OWN SERVICE
Some competent field mechanics, experienced in small parts assembly, repair their own governors in the field. Send us the serial number of the unit, tell us what it's controlling and inform us of any suspected deficiency. We'll send Instruction & Parts bulletins and suggest parts you may need.
If you have a number of governors, send your mechanic to our plant for two to four days training. Travel and living expenses are the only costs.

Similar services are available to our European customers at our Schiphol, Netherlands, facility.

WOODWARD SERVICE

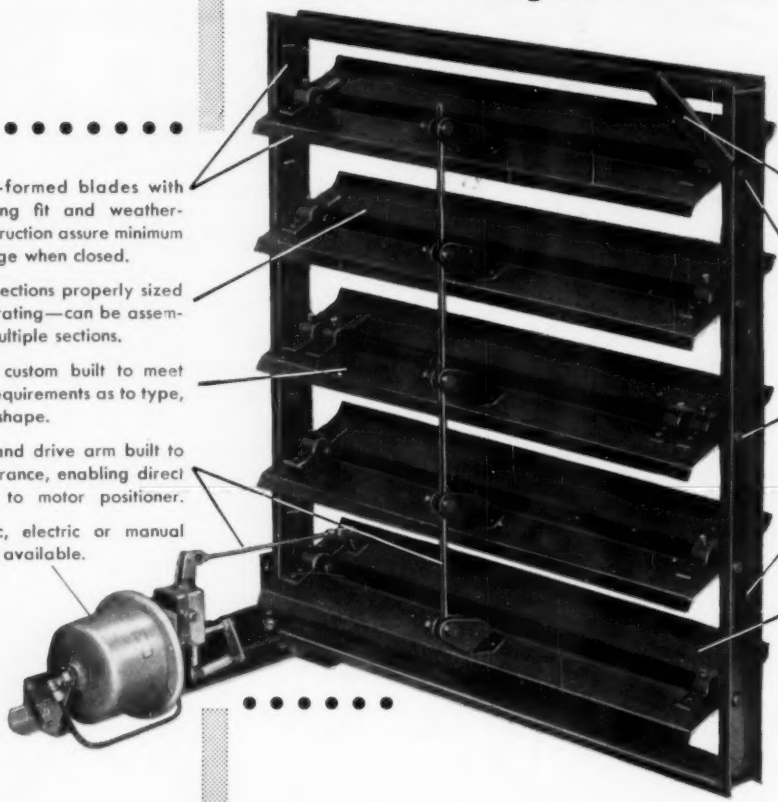
WOODWARD GOVERNOR COMPANY

ROCKFORD, ILLINOIS

Fort Collins, Colorado — Schiphol, The Netherlands

WORLD'S OLDEST AND LARGEST MANUFACTURER OF HYDRAULIC GOVERNORS EXCLUSIVELY

For *Dependable* air flow control . . . use Honeywell dampers



Precision-formed blades with overlapping fit and weather-stop construction assure minimum air leakage when closed.

Damper sections properly sized to motor rating—can be assembled in multiple sections.

Dampers custom built to meet specific requirements as to type, size and shape.

Linkage and drive arm built to close tolerance, enabling direct response to motor positioner.

Pneumatic, electric or manual actuation available.

Heavy-duty welded steel frame—welded steel corner bracing adds to rigid construction.

Rust-proof brass sleeve bearings give uniform, trouble-free operation.

Vertical or horizontal shafts can be supplied, extended shaft can also be provided for motor mounting outside of duct.

⅜-inch holes along all sides for easy duct mounting.

Blades carefully balanced and aligned to give smooth, uniform action.

You'll get lasting, trouble-free service from Honeywell dampers. Their heavy steel blades are specially formed to exact dimensions, and carefully balanced for smooth, uniform performance. Extra-heavy welded steel frames with steel corner bracing assure rigid construction . . . true alignment . . . consistent accuracy in positioning.

Louver, round or right-angle mixing types are available for pneumatic, electric or manual operation. Honeywell pneumatic or electric operators, or hand quadrants, can be supplied as the positioning means.

Call your nearby Honeywell field engineer for a discussion of your particular needs. He's as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, Wayne and Windrim Avenues, Philadelphia 44, Pa.

Honeywell

H HONEYWELL *First in Controls*

Brian P. Emerson
Editor

Joseph S. Cascio
Associate Editor

Alice Honore Drew
Assistant Editor

James E. Jones
President

Emma Corris
Circulation Mgr.

Wilmajeanne Bryant
Production Mgr.

Walter Miles
Art Director

Midwestern Office
Erwin Ruff, General Manager
Howard Sharp, District Manager
360 N. Michigan Ave.
Chicago 1, Illinois
Tel: FRanklin 2-7872

Pacific Coast Representatives
M. D. Pugh and Associates
P.O. Box 32188
Los Angeles 32, Calif.
Tel: CApitol 2-8857

Southwestern Representative
Ralph W. Runnels
The Runnels Company
5210 Morningside Drive
Houston 5, Texas
Tel: JAckson 4-6633

British Representatives
Newspaper Representations Ltd.
231-2 Strand,
London, W. C. 2, England

German Representative
Georg J. Linder
Linder Presse Union GmbH.
International Advertising Company
Wittelsbacher Alle 60
Frankfurt/Main, Germany

Publisher
G. Renfrew Brighton

Assistant Publisher
Wilbur W. Young

Subscription Rates

	Single Copies	1 year	2 years	3 years
U. S.	35¢	$4.00	$7.00	$ 9.00
Canada	35¢	4.00	7.00	9.00
Foreign	75¢	8.00	13.00	17.00

Diesel Power is indexed regularly by Engineering Index, Inc. and is available in microfilm editions from University Microfilms, Inc., Ann Arbor, Michigan.

DIESEL POWER, for November, 1957, Vol. XXXV, No. 11. It is published monthly by **DIESEL PUBLICATIONS, INC.**, Executive and Editorial Offices at **80 LINCOLN AVE., STAMFORD, CONN.** Tel. DAvis 4-2131. Entered as second class matter at the Post Office, Kutztown, Pa., under Act of March 3, 1879. Copyright 1957, Diesel Publications, Inc.

diesel power

Established in 1923 Vol. 35, No. 11 November, 1957

The Magazine of Piston and Turbine Power

Editorial

Spectrum of Power 29

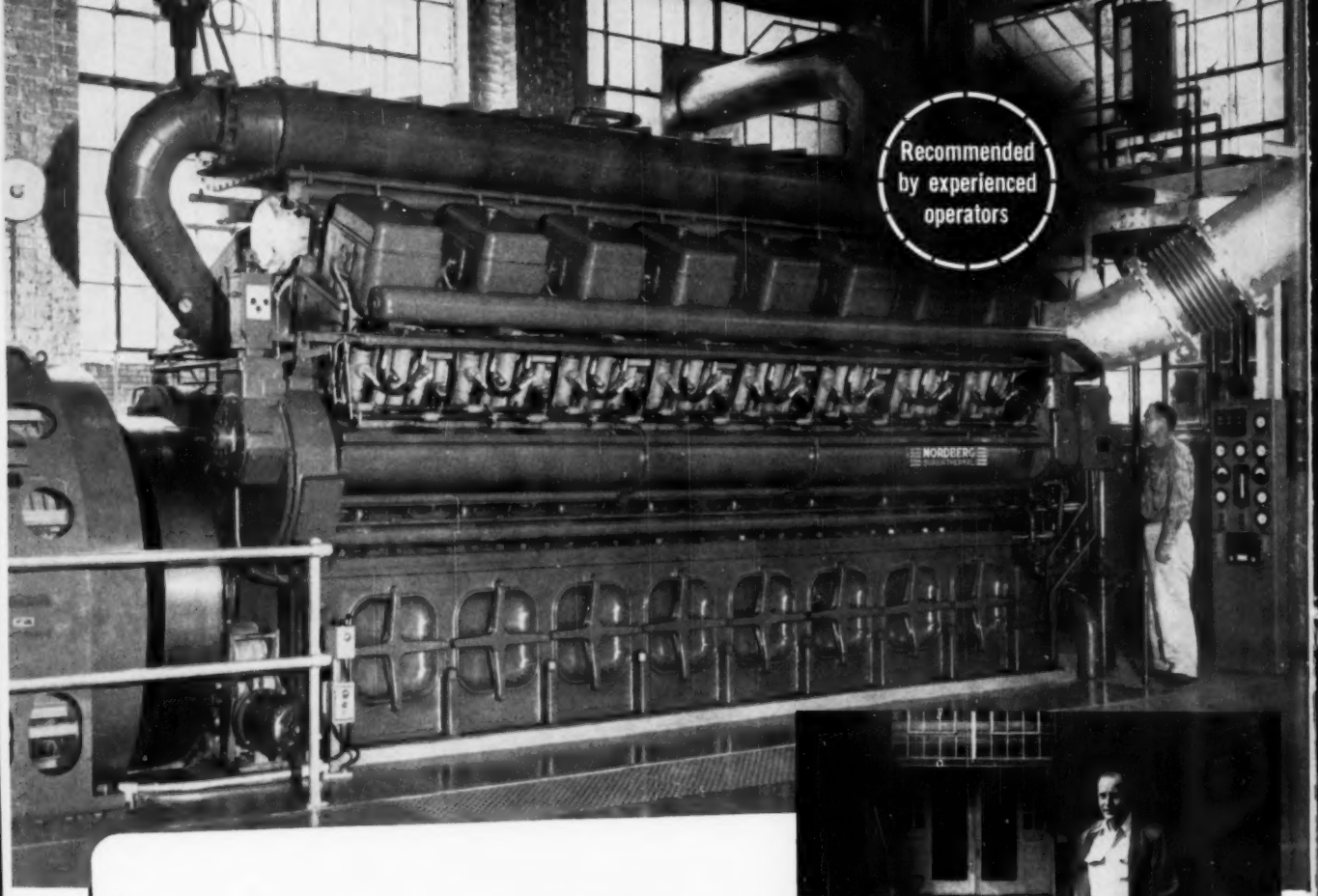
Articles

Breaking-In Rebuilt Engines 32
Metallurgy Makes the Difference 35
Rigid Service Schedule For Miami Pumps Pays Off 39
Valve Jobs Can Be Better 40
White Diesel Direct Drives Shovel Crane 42
New Cranking Battery for Diesel Locomotives 43
Get the Right Transmission 44
RR Diesels Conditioned for Mountains 46
Metallizing—A Reclamation Tool 48
American Bosch Hydrotor 51
Neodesha's Latest—Its Biggest 52
ADS Meeting Helps Everyone 54

Departments

Highlights 31
Service Section 55
News of Our Industry 56
New Products 60
Organizational News 64
New Literature 68
Advertising Index 78

Diesel Publications, Inc., 80 Lincoln Avenue, Stamford, Conn.



"Neodesha has now installed their sixth Nordberg engine ...all are giving a good account of themselves..."

...says Mr. Everett Powell,
Superintendent,
City of Neodesha, Kansas

Mr. Powell writes: "*The City of Neodesha has now installed their sixth Nordberg engine since 1922—all are giving a good account of themselves. Our newest, a 3150 B.H.P. Nordberg V-16 Supairthermal Duafuel unit, has been operating very satisfactory and we expect the same excellent service as recorded by our prior installed 1750 B.H.P. Duafuel unit. Our recent overhaul on this 1750 B.H.P. unit showed that rings and bearings still did not need replacement after 40,000 hours.*"

Here, then, are more reasons why Nordberg engines are recommended by experienced power plant operators . . . more reasons why there are so many *repeat* orders for Nordberg Diesel, Duafuel®, and Spark-Ignition Gas engines. Next time consult Nordberg on your power study . . . builders of a full range of engine sizes from 600 to over 12,000 hp. *NORDBERG MFG. CO., Milwaukee, Wisconsin.*

Installation Data:

1922—Installed 2 Nordberg 550 hp engines in Neodesha plant.

1934—Installed Nordberg 880 hp engine.

1946—Installed Nordberg 1620 hp engine.

1952—Installed Nordberg 1750 hp engine.

1956—Installed sixth Nordberg engine . . . a 16-cylinder V-type Supairthermal® Duafuel engine rated 3150 bhp, 2250 kw.

NORDBERG

DIESEL • DUAFUEL® AND SPARK-IGNITION GAS ENGINES

© 1957 Nordberg Mfg. Co.

P757

HARRISON CAPS THE HEAT!

Harrison-cooled GM Twin Diesel stays on the job 6½ years with no down time

Harrison provides endurance with assurance! This GM Twin Diesel drilled for oil on a 24-hour-a-day schedule for more than six years with no down time. And Harrison handled the heat every minute! This is typical of the rugged, trouble-free performance you can expect from Harrison heat exchangers. Harrison's 47 years' experience in the manufacture of heat-control products is your assurance of a top-quality product. If you have a cooling problem, look to Harrison for the answer.

HARRISON HEAT EXCHANGERS

Temperatures made to order for all types of diesel engines. Harrison heat exchangers are rugged, reliable and compact . . . engineered to provide the optimum in cooling efficiency.

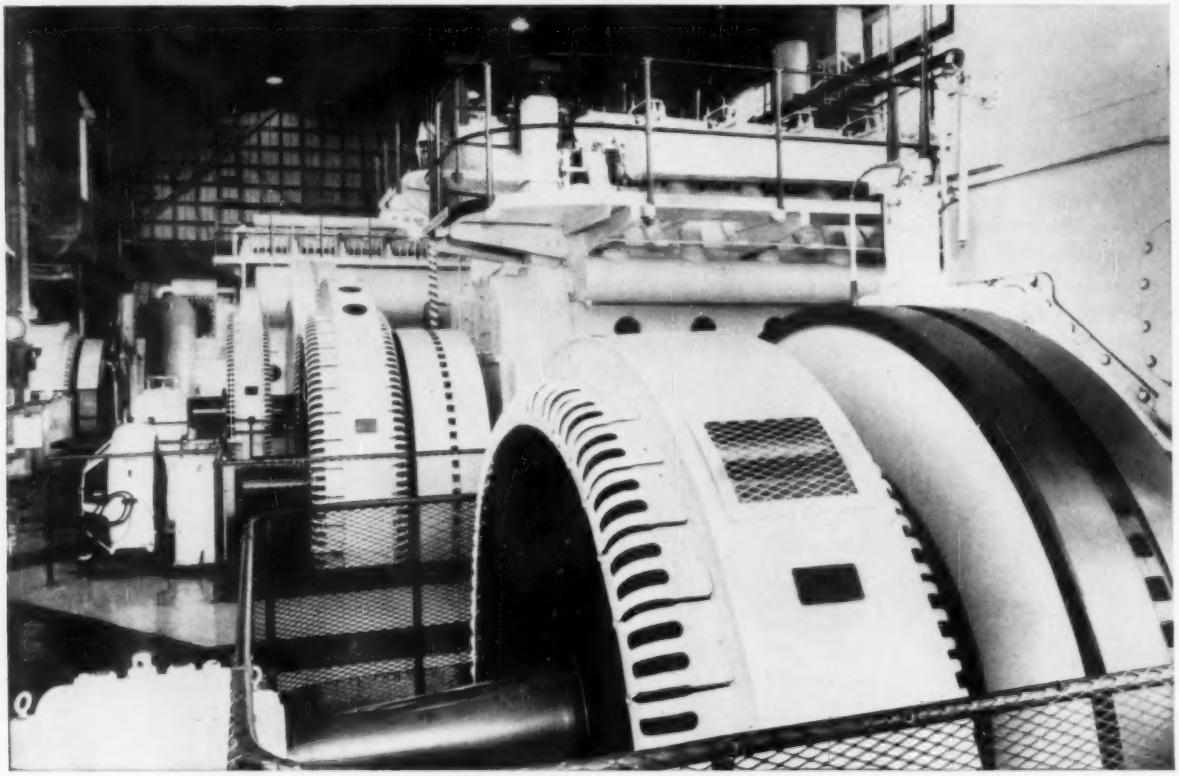
HARRISON

GM

FORWARD FROM FIFTY

HARRISON RADIATOR DIVISION • GENERAL MOTORS CORPORATION • LOCKPORT, N.Y.

Look to **COOK** for Better Rings!



Dependability and economy of Cook piston rings contribute to Vero Beach's expansion!

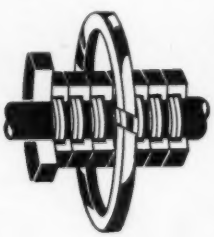
HERE you see the interior of the Vero Beach (Fla.) Municipal Power Plant—one of the most efficient and fastest-growing municipal power operations in all America . . .

In the foreground is a 1630-hp Nordberg Diesel engine. Behind it are two other Nordberg engines — one a 4050-hp unit, the other a 4500-hp unit. Now being installed, but out of the picture, is still a fourth Nordberg — this one rated 7550-hp.

The newest Nordberg, a 29" bore engine, will bring Vero Beach's plant capacity up to 13,925 kw — *or more than five times the 2450-kw capacity of just five years ago!*

Cook Oil Control Rings are used in the first three of these engines, and *all* Cook Rings have been specified for the fourth Nordberg, now being installed!

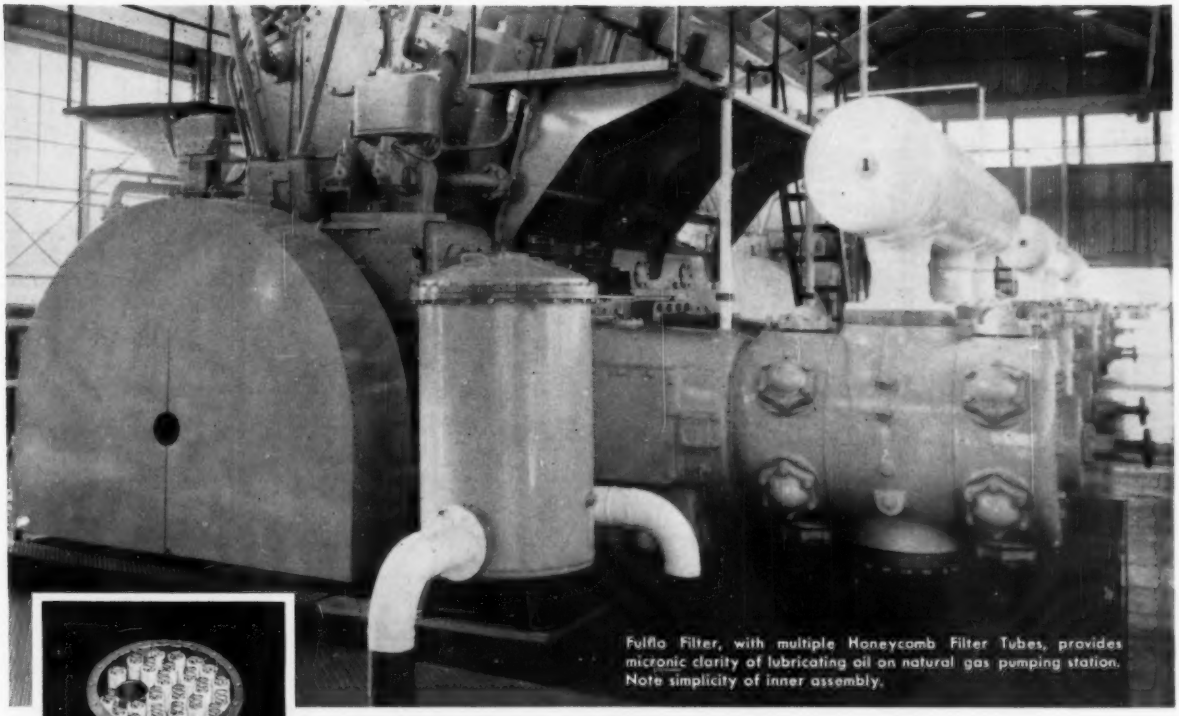
Whatever your piston-ring requirements—Plain, Full Sealing, Segmented or Oil Wiper—there's a "job-engineered" Cook Ring to fill the bill. Write direct for all the facts. C. Lee Cook Company, 946 South 8th Street, Louisville 3, Kentucky.



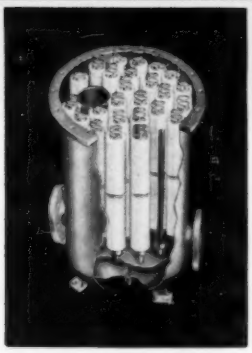
C. LEE COOK COMPANY

Division of Dover Corporation

Rings and Packings Since 1888



Fulflo Filter, with multiple Honeycomb Filter Tubes, provides micronic clarity of lubricating oil on natural gas pumping station. Note simplicity of inner assembly.



Fulflo Filters pioneered to give you longer engine life... low cost maintenance

Fulflo was the first successful application of a full-flow lubricating oil filter on high horsepower diesel engines. Now, Fulflo Filters provide micronic clarity of both fuel and lubricating oil for all sizes of stationary engines, mobile equipment and for bulk filtration. You save through reduced wear on injectors, reduced bearing wear, lower maintenance costs.

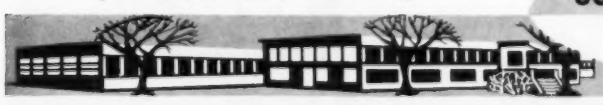
Exclusive Honeycomb Filter Tubes give you true depth filtration to any desired degree of micronic clarity. Densities are positively controlled in manufacture. Low-cost Honeycomb Filter Tubes are easy to replace. Don't accept substitutes!

CFC

CFC Oil Filters (including Honan-Crane models) employ a variety of filter media for removal of soluble as well as solid impurities. Multi-cartridge Filter (illustrated) offers a choice of six types of interchangeable cartridges depending on type and degree of filtration desired. CFC Michiana Filters, with "throw-away" or repackable elements, provide especially low-cost filtration.

For engineering assistance or technical literature, write Department DR

Micro-Fine Filtration for Low Cost Clarity

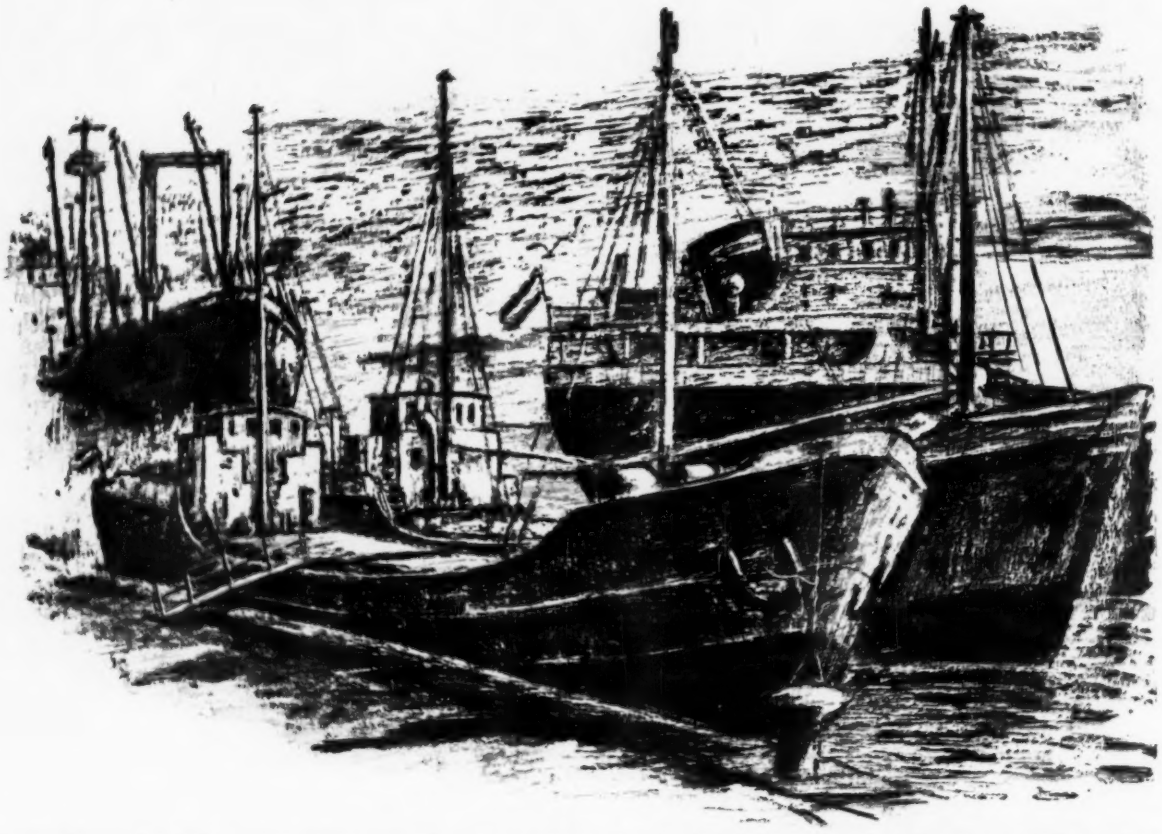


COMMERCIAL FILTERS CORPORATION

MELROSE 76, MASSACHUSETTS

Plants in Melrose, Massachusetts and Lebanon, Indiana

FULFLO FILTERS WITH GENUINE HONEYCOMB FILTER TUBES FOR CONTROLLED MICRONIC CLARITY • CFC MULTI-CARTRIDGE OIL FILTERS
PURIVAC INSULATING OIL CONDITIONERS • DRI-PURE WATER-OIL SEPARATORS • PRE-COAT FILTERS • MAGNETIC SEPARATORS
AUTOMATIC TUBULAR CONVEYORS • COOLANT CLARIFIERS

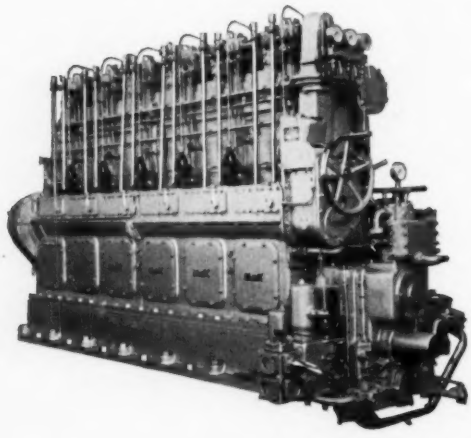


DIRECTLY ON THE BUSIEST NAVIGABLE WATERWAYS OF THE BALTIC SEA

next to the floodgates of the North Sea-Baltic Canal there are situated the wharfs of *MaK*.

Experts of the *MaK* service workshops are testing here marine engines for capacity and economy.

Apart from the well-known advantages of the MaK Diesel engines it is the unique *MaK* service which is always ready for use and therefore is fully appreciated everywhere in navigation circles.



Some technical data of the series M423 type engine which stands the test extraordinarily as main engine and servo-motor:

4, 6 and 8 cylinders—bore and stroke 290 / 420 mm cylinder output without supercharging 75 HP at 428 r.p.m.

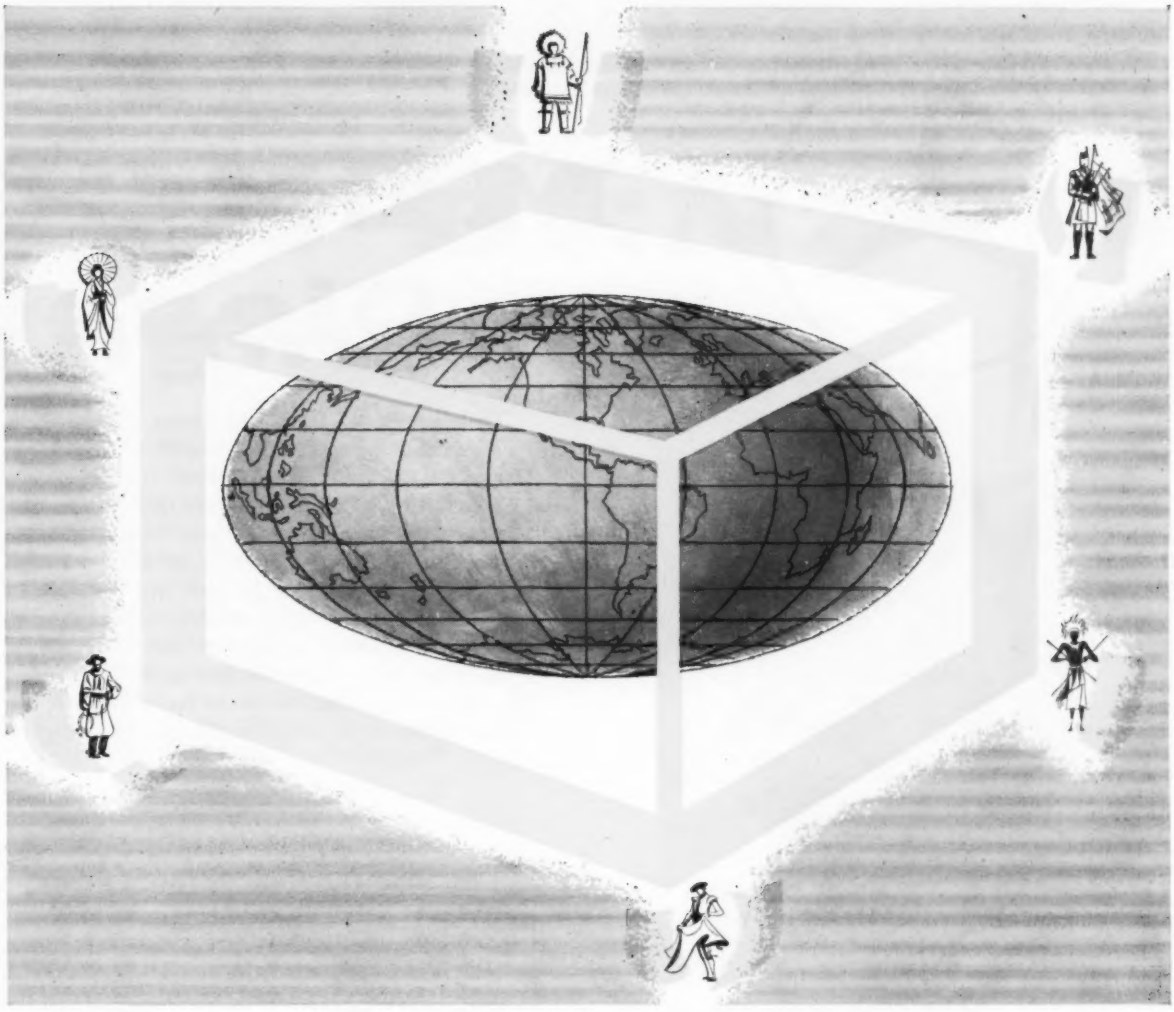
6 and 8 cylinder engine also with supercharging up to 50% increase of the cylinder output up to approximately 112 HP range of capacity from 185 up to appr. 900 HP at 265 to 428 r.p.m.

MaK-engines approved on all waterways and railways.

MaK

MASCHINENBAU KIEL AKTIENGESELLSCHAFT

GERMANY



In the far corners of the globe...

The performance and the brand are the same around the world

Other outstanding Shell Industrial Lubricants

Shell Tellus Oil—for closed hydraulic systems

Shell Alvania Grease—multi-purpose industrial lubricant

Shell Turbo Oils—for utility, industrial & marine turbines

Shell Dromus Oil—cutting oils for high-production metalworking

Shell Talona R Oil 40—anti-wear crankcase oil for diesel locomotives

Shell Rimula Oil is a heavy-duty oil designed to solve the toughest lubricating problems in diesel engines.

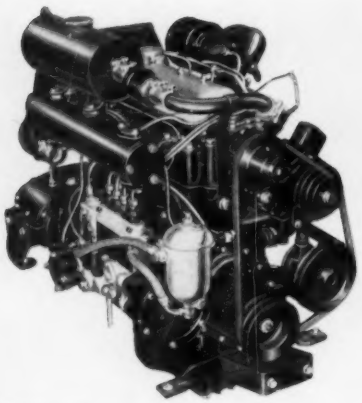
Rimula® Oil reduces cylinder and bearing wear caused by acidic combustion products that are increased by low jacket temperatures. It remains stable under the widest temperature extremes encountered in modern operation. It keeps engine parts clean and operating efficiently over longer periods...effecting worth-while savings in labor and parts.

Rimula Oil, regarded in the U.S.A. by manufacturers and operators as an indispensable accessory to heavy-duty vehicular operation, is available to your customers abroad under the same brand. For full information, write: Shell Oil Company, 50 West 50th St., New York 20, N. Y., or 100 Bush St., San Francisco 6, Calif.

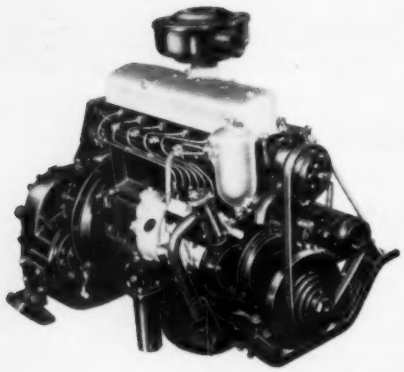
SHELL RIMULA OIL

SHELL

MERCE
Diesel



MODEL OM 636



MODEL OM 321

These engines — the world's finest diesels — are now available for sale through the Utica-Bend Division of the Curtiss-Wright Corporation, to manufacturers and users of industrial, marine, construction and materials handling, trucks and busses, railroad, electrical generating, agricultural, oil and gas equipment. . . The Utica-Bend Division will both import and manufacture the Mercedes-Benz diesels, ranging from 36 to 3000 h.p., together with components, spare parts, accessories and fuel injection systems. Mercedes-Benz diesels are noted the world over for their high power to weight ratios and are designed

MODEL NO.	NO. OF CYL.	RATING* HP @ RPM
OM 636	4	36 @ 3000
QM 312	6	79 @ 2400
OM 321	6	96 @ 2600
OM 315	6	123 @ 1800
M 204 B	4	129 @ 1200
†MB 846 A	6	242 @ 1500
†MB 846 Ab	6	320 @ 1500
MB 836 B	6	360 @ 1500
MB 846 Db	6	375 @ 1500
MB 837 A	V-8	451 @ 2000
MB 836Bb	6	513 @ 1500
MB 837 Aa	V-8	564 @ 2000
MB 836 Db	6	666 @ 1600
MB 820 B	V-12	718 @ 1500
MB 820 Bb	V-12	1026 @ 1500
MB 820 Db	V-12	1385 @ 1500

Ab TURBOCHARGED Db HIGH OUTPUT TURBOCHARGER

*INDUSTRIAL INTERMITTENT

Other Mercedes-Benz Diesel Engines Available In 12 And 20 Cylinders Up To 3000 Horsepower

AD NO. 29-2

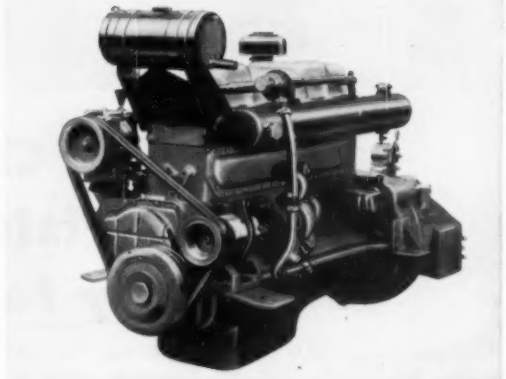
DES-BENZ Engines

and built to the highest standards of quality, performance and economy. . . Unusually long engine life and dependable operation under extreme climatic conditions are made possible by their exclusive design. . . The sales and service program for Mercedes-Benz diesels, now being established by Utica-Bend, provides for sales representation in key areas and facilities for servicing of engines and distribution of spare parts to assure full maintenance of equipment in the field. . . For further information, write to: UTICA-BEND DIVISION, CURTISS-WRIGHT CORPORATION, UTICA, MICHIGAN.

DISPL. CU. IN.	WEIGHT LBS.	APPROXIMATE DIMENSIONS LENGTH	WIDTH	HEIGHT
108	400	2'5"	1'9"	2'6"
280	808	3'1"	2'2"	3'5"
311	784	3'1"	2'2"	3'5"
505	1775	4'6"	2'3"	3'11"
789	2715	4'9"	2'7"	3'11"
1230	4075	6'2"	2'8"	5'
1230	4298	7'2"	3'1"	5'2"
1806	3560	6'4"	3'5"	4'7"
1230	4266	7'0"	2'10"	5'2"
1823	2970	4'1"	3'5"	3'6"
1806	4080	7'	3'5"	5'4"
1823	3080	4'2"	3'5"	3'8"
1806	4290	7'6"	3'5"	5'4"
3613	5510	8'	4'5"	6'1"
3613	6116	7'11"	4'5"	6'5"
3613	6612	7'11"	4'6"	6'1"

Aa MECHANICAL SUPERCHARGER † AVAILABLE IN HORIZONTAL CONFIGURATION

MODEL OM 312

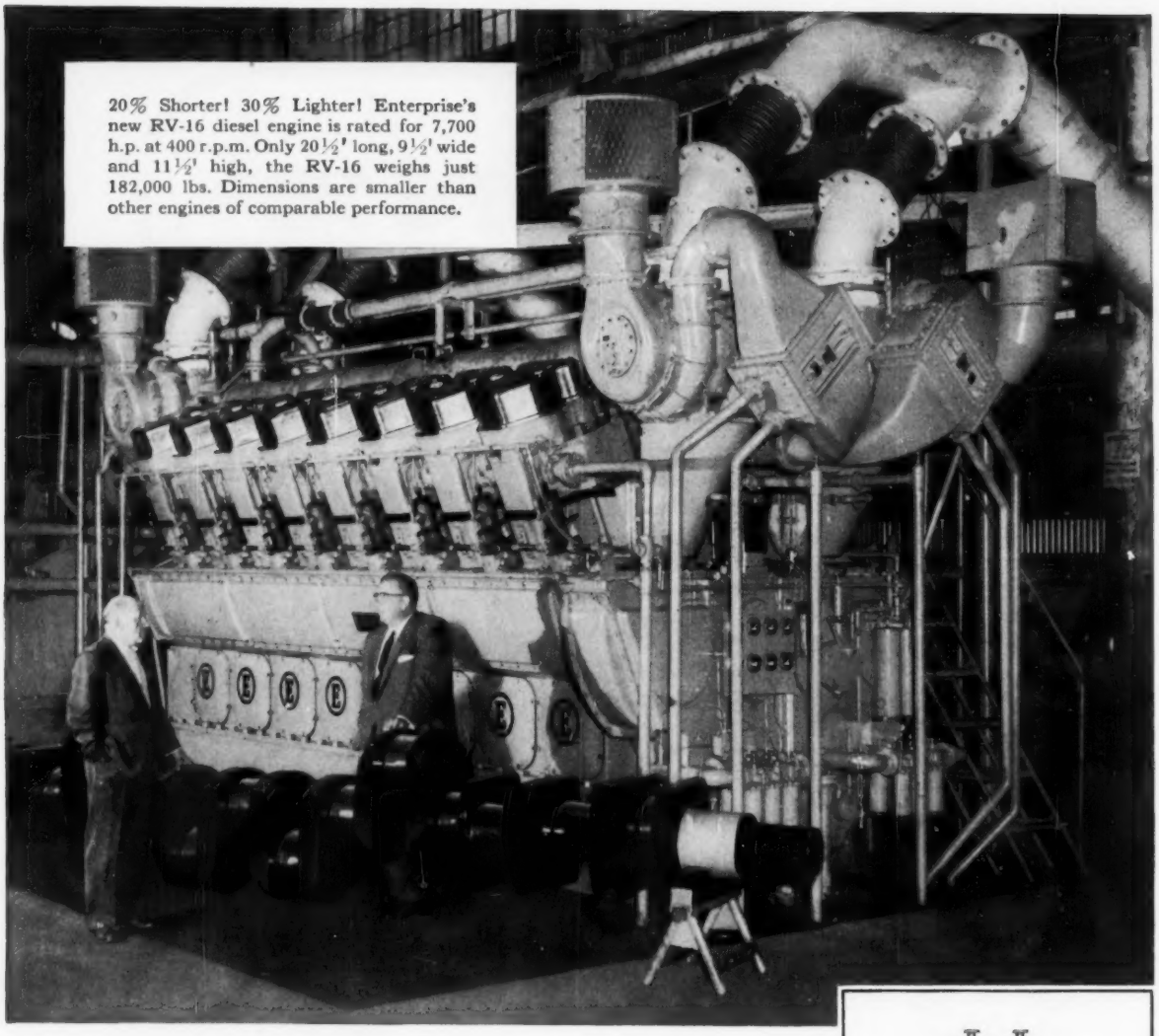


MODEL OM 315

UTICA-BEND DIVISION

CURTISS-WRIGHT

CORPORATION • UTICA, MICHIGAN



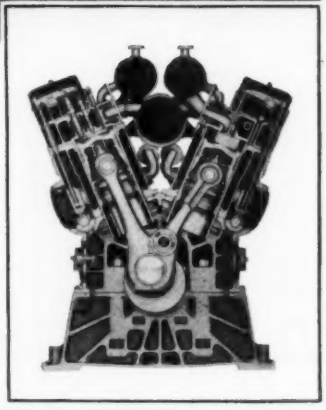
20% Shorter! 30% Lighter! Enterprise's new RV-16 diesel engine is rated for 7,700 h.p. at 400 r.p.m. Only 20½' long, 9½' wide and 11½' high, the RV-16 weighs just 182,000 lbs. Dimensions are smaller than other engines of comparable performance.

Enterprise Chooses KOPPERS Piston Rings Exclusively for RV-16

Prototype of a new line of industrial diesel engines, the RV-16, built by Enterprise Engine & Machinery Co., of San Francisco, is designed for such rugged operations as delivering main propulsion in towboats and seagoing freighters, or supplying power for pumping stations or electric generation.

As many other leading manufacturers have done, Enterprise has selected Koppers Piston Rings exclusively. Koppers wide range of types and sizes . . . variety of material selection . . . control of material quality . . . close tolerance performance . . . rigid standards of inspection—all contribute to Koppers leadership in the field of industrial piston and sealing rings, making Koppers the most dependable source of supply.

If you have a problem of ring application, avoid further needless expense. Take advantage of Koppers experience, research facilities and craftsmanship. Write for information today. KOPPERS COMPANY, INC., Piston Ring and Seal Department, 1311 Hamburg Street, Baltimore 3, Maryland.



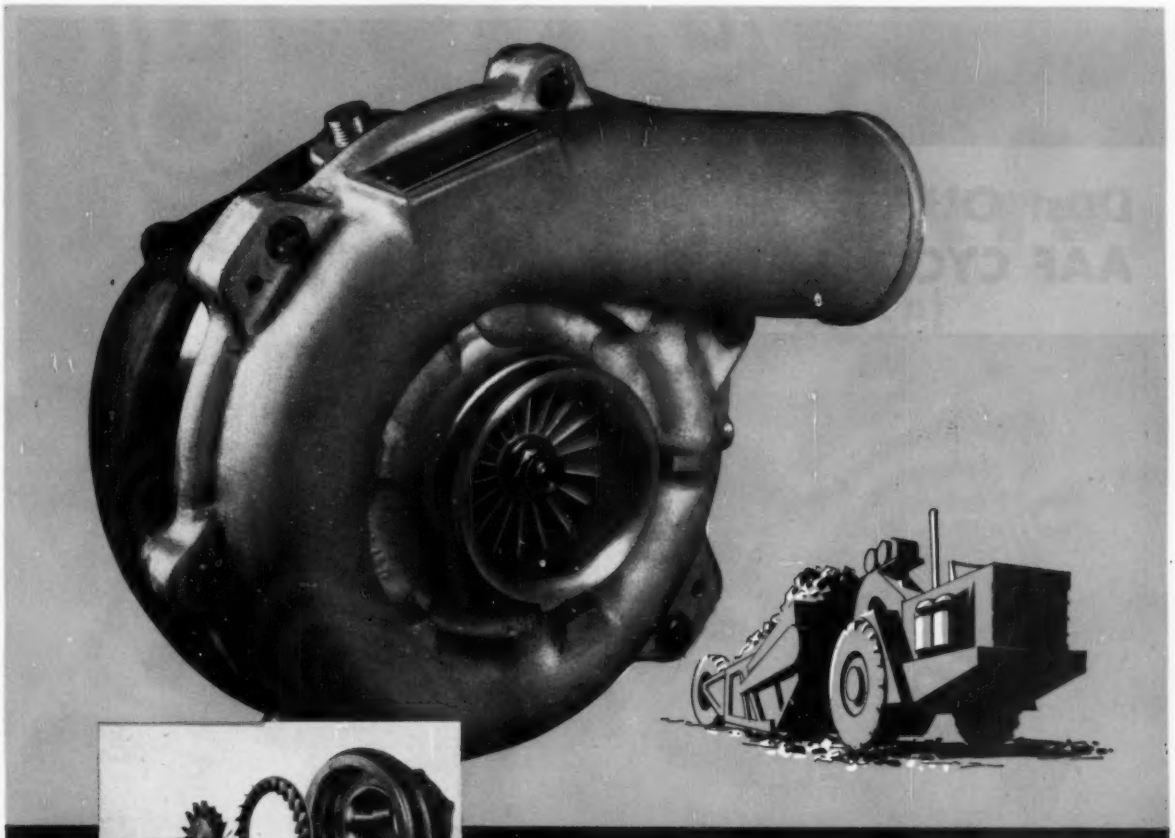
Cutaway shows internal design of the RV-16

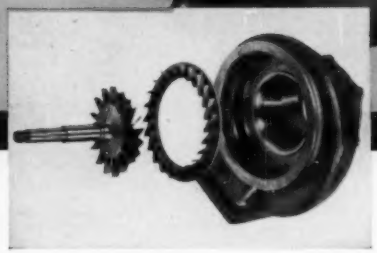
KOPPERS

AMERICAN HAMMERED

Industrial Piston Rings

Engineered Products Sold with **Service**





NEW! Rugged Turbine Design Means Less Maintenance with Thompson Turbochargers

Turbine parts on new Thompson Turbochargers are crack- and corrosion-free, thanks to use of a heat-resistant alloy and close attention to design! Built to withstand turbine inlet temperatures of over 1500 degrees, the Thompson turbine is designed to deliver a minimum of 10,000 hours of trouble-free service. Studs have been eliminated from this high temperature section for easier installation and longer life.

You'll find other advanced features in the bearing and compressor sections of new Thompson Turbochargers. Careful location of simple, one-piece bearing has resulted in high critical speeds at smaller shaft diameters. Straight rotor vanes simplify compressor design, maintain highest efficiencies at lower rotor speeds.

Let our engineers show you how you can economically increase the horsepower of your diesel engines up to 100%. New Thompson Turbochargers are available in sizes to efficiently blow diesels from 50 to 300 horsepower.

Write on your company letterhead for Booklet DP-1157, containing detailed information on Thompson Turbochargers.

JET DIVISION

Thompson Products, Inc.

Cleveland 17, Ohio

Dust OUT, Clean Air IN—
AAF CYCOILS do the job!

Photo by Elwood M. Payne, Houston

AAF Cycoils play an important part at the Shell Oil Company's Sheridan, Texas cycling plant. Dust stays out of engines and compressors, only clean air goes in.

WHEN you have fourteen compressors working full-time, you want to be sure you have complete protection against dust. That's why the Shell Oil Company chose Type W AAF Cycoils for its important gasoline cycling plant at Sheridan, Texas. Only *maximum* protection is enough with an investment like this at stake.

AAF Cycoil heavy-duty oil bath air cleaners deliver 4-way cleaning: impingement, scrubbing, cyclonic action and filtering. Actual tests, plus on-the-job operation, prove that more than 90% of the fine dust content of air is trapped in oil and removed by centrifugal action—*before it even reaches the filter pads.* No wonder Cycoils deliver air that's virtually 100% *dust-free.*

Only AAF Cycoil Oil Bath Air Filters offer engines and compressors such protection, save so much money and trouble. For full information, write today for Bulletin No. 130. It's packed with facts—has all the details.

AAF herman nelson

American Air Filter
COMPANY, INC.

445 Central Avenue, Louisville 8, Kentucky
American Air Filter of Canada, Ltd., Montreal, P. Q.

Type CMS Multi-Duty Filters

Type G Pipeline Air Filters

BETTER AIR IS OUR BUSINESS

Type OCH Intake Air Filters

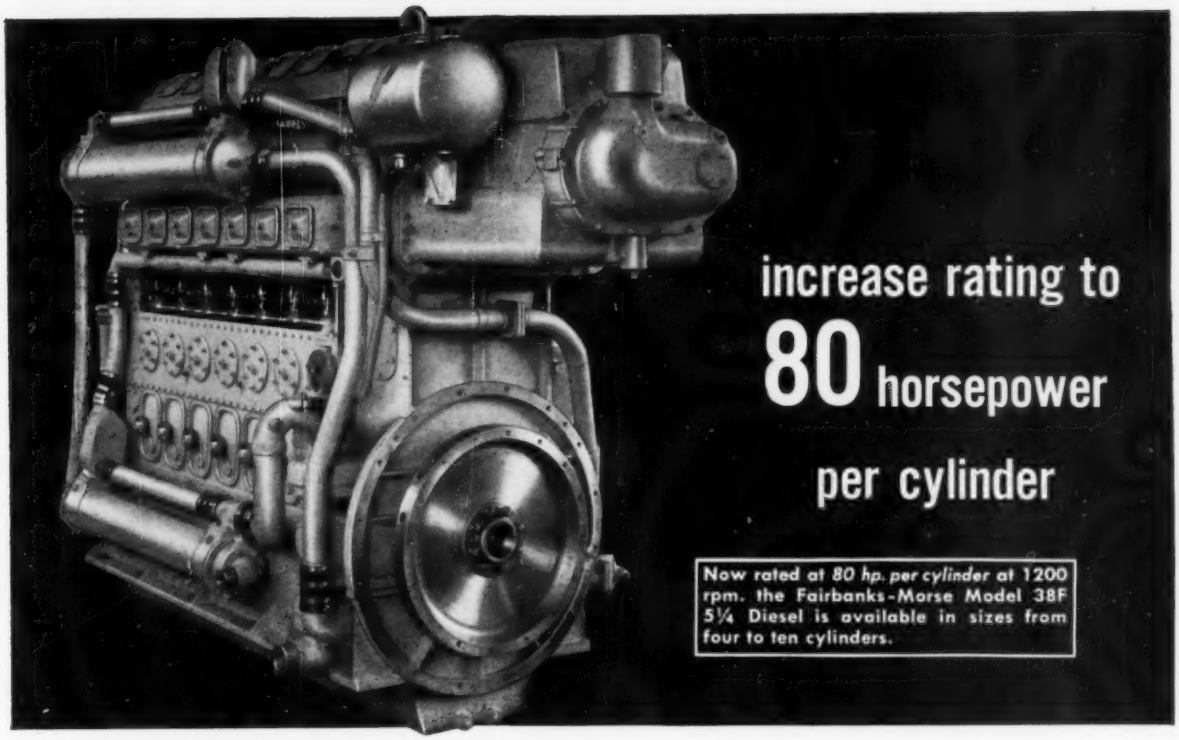
Cycoil Oil Bath Air Filters

Where performance is the measure

F-M Power is the standard

NOW 7 IMPROVEMENTS

in the Model 38F O-P Diesel


increase rating to
80 horsepower
per cylinder
Now rated at 80 hp. per cylinder at 1200 rpm. the Fairbanks-Morse Model 38F 5¼ Diesel is available in sizes from four to ten cylinders.

Latest improvements in the Model 38F O-P combine to increase the rating to 80 hp. per cylinder. All 7 are thoroughly tested and field-proven—making the "Little O-P" better than ever.

1 One-piece piston with full floating piston pin. Mechanically simple, more reliable, lighter and still retains superior oil cooling feature.

2 Vertical drive through a new coupling. The O-P now has an even wider range of speed operation from idle to full speed.

3 Raised exhaust ports. Increases time between port cleanings and improves fuel consumption.

4 Alternate starting options. Now available for all sizes: air motor start, electric start as well as distributor air start.

5 Engine mounted oil bath intake filters. Eliminates intake pipe and remote filter mounting with its extra structural cost . . . more self-contained unit.

6 Factory mounted controls for remote and automatic starting, scheduled acceleration, deceleration and stop. Meets all requirements of both air start and electric start engines.

7 New fuel injection pumps for improved handling of fuel at the increased rating.

IT ADDS UP—more than ever before—to more power to you with an O-P Diesel

FAIRBANKS-MORSE

a name worth remembering when you want the BEST

DIESEL AND DUAL FUEL ENGINES • DIESEL LOCOMOTIVES • RAIL CARS • ELECTRICAL MACHINERY • PUMPS • SCALES • HOME WATER SERVICE EQUIPMENT • MAGNETOS

There's no substitute for the FORGED crankshaft

Crankshaft forgings illustrated, left to right, for V-8 passenger car, diesel truck and heavy tractor engines

Crankshafts have been made successfully by other methods of fabrication and have proven to be *good enough* for certain non-critical applications — but for maximum dependability of the modern, compact, high compression, high torque engine a forged crankshaft is essential.

The forging process assures, to the greatest degree possible, uniformity and predictability of physical properties with a minimum variance from piece to piece or from one location to another in the same piece.

Wyman-Gordon has been forging crankshafts since the beginning of the internal combustion engine era and today produces more crankshafts for a greater variety of applications than any other company in the world. In a crankshaft there is no substitute for a forging, and in a forging there is no substitute for Wyman-Gordon quality and experience.

WYMAN-GORDON COMPANY

Established 1883

WORCESTER 1, MASSACHUSETTS
HARVEY, ILLINOIS • DETROIT, MICHIGAN

FORGINGS OF ALUMINUM • MAGNESIUM • STEEL • TITANIUM

DIESEL FUEL and LUBRICATION

BULLETIN

CITIES SERVICE

WHAT CAUSES LUBRICATION FAILURES?

The biggest single reason for lubrication failure is improper selection and application of lubricants.

Today's lubricating oils are made for highly specialized purposes. The fact that an oil seems ideal for the requirements of one piece of equipment is no guarantee of its qualifications for other machinery.

For example, choice of an oil with low detergency may result in stuck rings, excess cylinder wear, injector clogging, bearing wear and other diesel difficulties.

Next time you're considering what type of oil to use for a certain piece of equipment, call in a Cities Service Lubrication Engineer. He not only has the precise oil for the particular unit you want to lubricate, but may be able to simplify your entire lubrication picture and reduce maintenance costs as well.

USERS ACCLAIM CITIES SERVICE C-300 OIL

From a strip miner comes this report: "Shovel and dragline work 20 hrs. a day, seven days a week. Each have rolled up over 14,000 hrs. with no major overhaul, using Cities Service C-300 Motor Oil."

From a leading stone company: "Our six stationary diesels, powering our compressors and crushers, have averaged 12,000 hours each before major overhaul, with Cities Service C-300 Oil."

From a trucking company: "Our 20 diesels get up to 225,000 miles before overhaul with Cities Service C-300 Oil. We don't even grind the valves before then."

With excellent oxidation resistance, high detergency, and low carbon residue, Cities Service C-300 Oil may be the perfect lubricant for your machinery, too.

Get the facts from a Cities Service Lubrication Engineer. Or write: Cities Service Oil Company, Sixty Wall Tower, New York 5, N. Y.

USING A SULPHUROUS FUEL? TRY THIS NEW CITIES SERVICE OIL

If you're using a diesel fuel with high sulphur content, your motor oil must do more than its normal share of work to fight engine deposits.

Cities Service C-100 Motor Oil has been formulated for just this purpose. Under dusty, dirty, and sulphurous conditions, it provides excellent engine lubrication and protection. Talk with your Cities Service Lubrication Engineer for details.

MAN YOU SHOULD KNOW

Barney Fleming is the Regional Manager of Industrial Oil Sales at the Cities Service office in St. Paul, Minnesota. With a background of 35 years as a lubrication engineer and a talent for solving problems, he is typical of the Cities Service engineering staff that's at your service. A call to the nearest Cities Service office will bring a member of this staff to your plant or job site.

the PRR railroad uses PEDRICK PISTON RINGS in Baldwin and GENERAL MOTORS Engines

Many of the Diesel-electric locomotives of Pennsylvania Railroad are powered by Baldwin or by General Motors diesel engines. The approval of PEDRICK piston rings for replacement service in these engines by one of the world's great railroads followed a 2-year testing period.

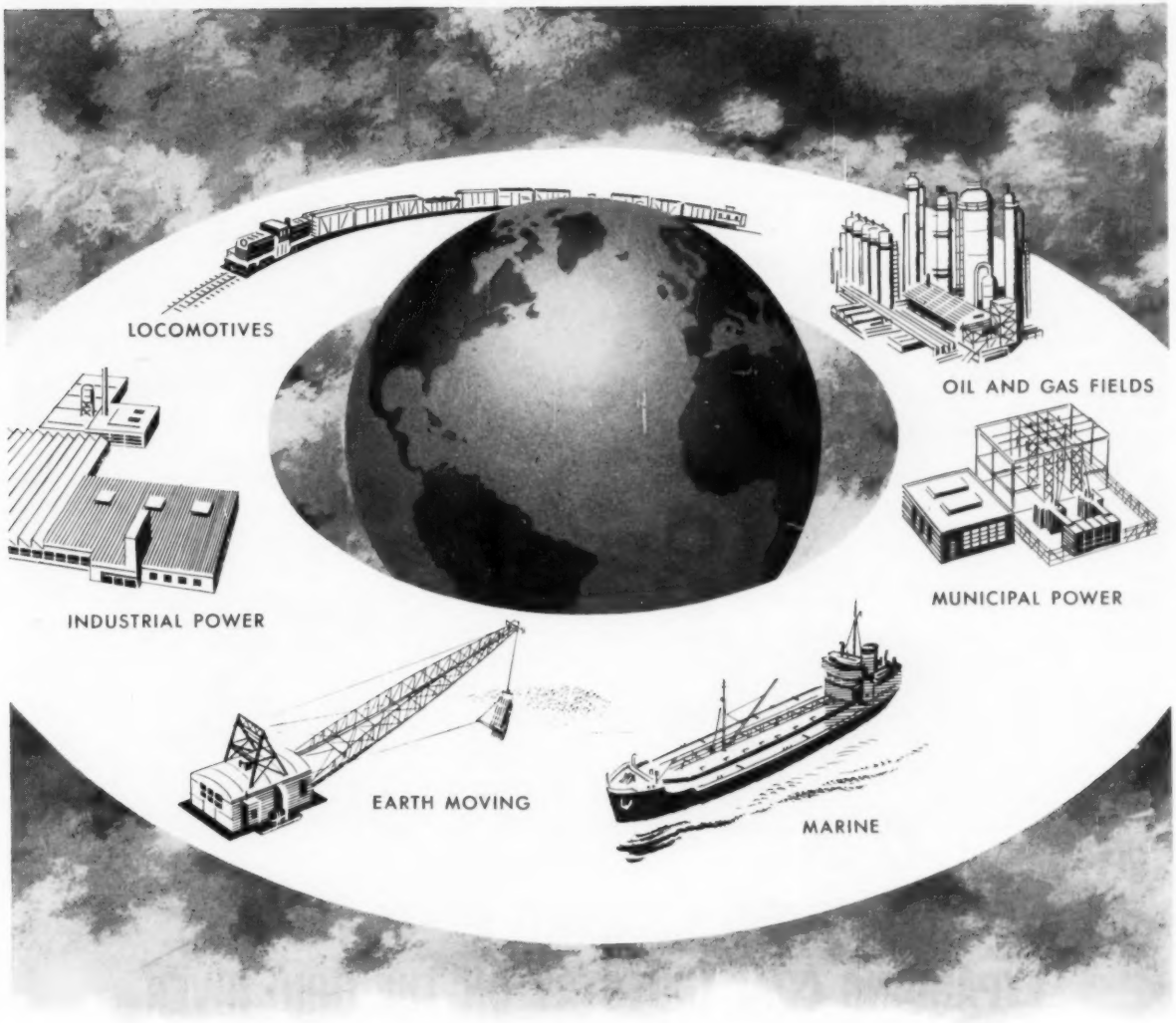
PEDRICK Engineered Sets provide excellent combinations of the most modern piston-ring designs for maximum performance and longest life in each particular engine. No matter where your engines operate—in locomotives, in the oil fields, in boats, in compressor stations, in power plants, in excavating or road-building machinery—you can get a PEDRICK Engineered Set specially designed to give you the results you want—dependability, minimum down-time, minimum lube-oil consumption, full power and long life.

PEDRICK PIONEERED CONFORMABLE RINGS FOR BIG-BORE ENGINES

Pedrick

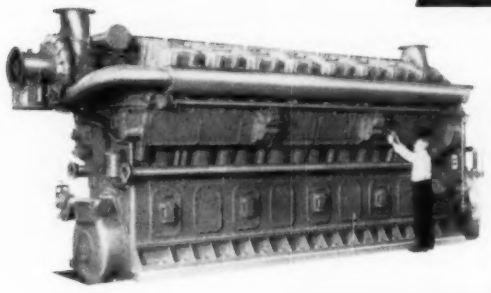
PISTON RINGS

WILKENING MANUFACTURING CO., Philadelphia 42 and Toronto 2



The power of COOPER-BESSEMER circles the earth

Mount Vernon, Ohio
Grove City, Pa.



THE use of reliable Cooper-Bessemer power has spread not only to many sections of the world, but also to a wide range of heavy-duty Diesel and gas engine applications.

Recognized for outstanding performance under rugged operating conditions, Cooper-Bessemers offer unsurpassed sturdiness, long service life, minimum maintenance, compactness and low over-all operating expense.

For detailed bulletins and information that will help solve your powering or repowering problems, drop in or write to your nearest Cooper-Bessemer office. Cooper-Bessemer units are available for every power requirement from 200 to 5000 bhp.

Built by Dravo Corp.	For Island Creek Fuel and Transportation Co.	Powered by Enterprise Diesel Engines	with Bendix FUEL INJECTION EQUIPMENT

TOWBOAT RAYMOND E. SALVATI MEETS THE NEEDS OF EXPANDING COAL INDUSTRY ON THE OHIO RIVER

The new towboat, Raymond E. Salvati, built by Dravo Corporation for Island Creek Fuel and Transportation Company is truly quite a boat. In the first place, she is a giant of a vessel; second, she packs a whale of a lot of power; and third, she is an unusually handsome boat.

The Salvati is eminently well suited to meet the needs of an expanding coal industry on the Ohio River. It pushes a fleet of 20 standard 900-ton coal barges or 15 "jumbo" 1500-ton barges up the Ohio against the current on an average tow.

Powering the Salvati are two Enterprise marine diesel engines with Bendix* Fuel Injection Equipment that develop 2560 H. P.

The hull and superstructure of the Salvati are welded steel throughout. The main deckhouse, upper deckhouse and pilot house comprise the major portion of the superstructure. Quarters and lounge for the eight-man crew, a galley, mess room, machinery space, steering gear compartment and stove space are provided in the main deckhouse.

In every respect the Raymond E. Salvati is something special. And when it comes to fuel injection, something special was selected—Bendix Fuel Injection, the industry's choice for long life and low operating costs.

*REG. U.S. PAT. OFF.

Scintilla Division
SIDNEY, N. Y.

Bendix
AVIATION CORPORATION

The Engineer's Field Report

CASE HISTORY

PRODUCT Chevron Starting Fluid

FIRM Great Northern Railway Havre, Montana

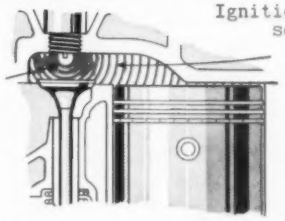
Special fluid starts 250-ton crane instantly, saves time in emergencies—even at 50° below

GREAT NORTHERN RAILWAY'S 250-TON, RAILROAD CRANE (above) starts instantly with Chevron Starting Fluid in temperatures ranging to 50° below zero—even after standing idle for months at a time. Former steam-powered wrecker equipment took crew 12 hours to start. This crane with its two 174 h.p. Cummins diesel engines is now available for derailment emergencies on short notice.

"Slow-grind starts on battery power alone waste too much valuable time. Chevron Starting Fluid fires these engines 'right now'—in any weather." A Great Northern engineer shows how simple it is to insert 7CC gelatin capsule of Chevron Starting Fluid in unit's air-intake system. Fluid is also available in 17CC capsules and 1-pint cans.

Why Chevron Starting Fluid starts engines instantly

Highly volatile: 7 times more than gasoline



Ignition temperature several hundred degrees lower than diesel fuel

Contains wear-reducing lubricants

Additives inhibit ice formation

CHEVRON STARTING FLUID

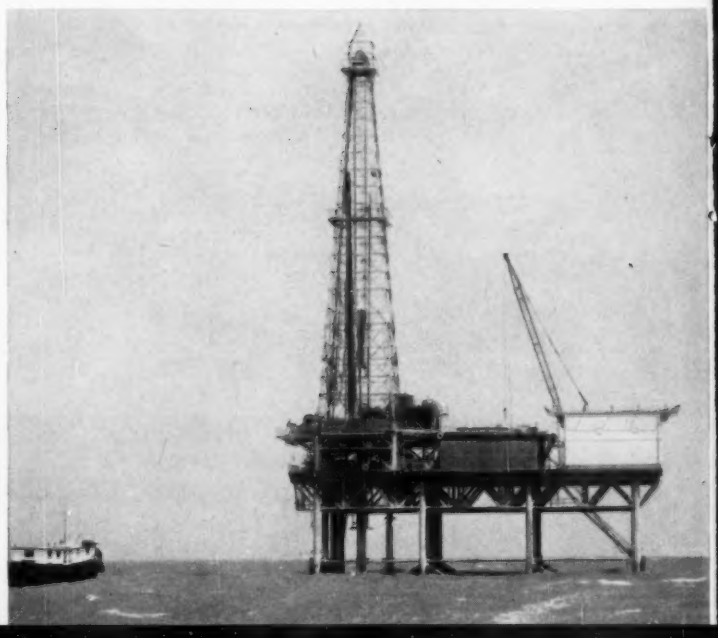
FREE FOLDERS tell more about the Chevron Starting Fluid and Chevron Pressure Primer System. Write or ask for them.

FOR MORE INFORMATION about this or other petroleum products of any kind, or the name of your nearest distributor, write or call any of the companies listed below.

TRADEMARK "CHEVRON" AND DESIGN REG. U. S. PAT. OFF.

STANDARD OIL COMPANY OF CALIFORNIA, San Francisco 20 • STANDARD OIL COMPANY OF TEXAS, El Paso
THE CALIFORNIA OIL COMPANY, Perth Amboy, New Jersey • THE CALIFORNIA COMPANY, Denver 1, Colorado

Gulf Marine's new submersible barge is powered by three Electro-Motive 900 hp generator sets. Drive motors are located on rotary, draw works and mud pumps. Barge is shown here under construction at Burton's in Port Arthur. It can drill in water depths up to 30 feet.



Permanent platform rig was put into service in March. It is presently drilling in the East Cameron area in twenty feet of water. Unit has two Electro-Motive 875 hp generator sets with drive motors on rotary, draw works and mud pumps.

NEW COMPANY LAUNCHES TWO RIGS IN ONE YEAR

Gulf Marine uses Electro-Motive Power on both—likes the advantage of "one responsibility"

Gulf Marine Drilling Company of Morgan City, La., is celebrating its second year of business with two new rigs. One, a platform, was put into service in March. The other, a submersible barge, was launched in September.

In discussing why they picked Electro-Motive Power, Gulf Marine placed top importance on these three things: number of rigs using Electro-Motive Power, parts and service facilities available and the fact that one company—Electro-Motive—was responsible for and sole manufacturer of the complete power system.

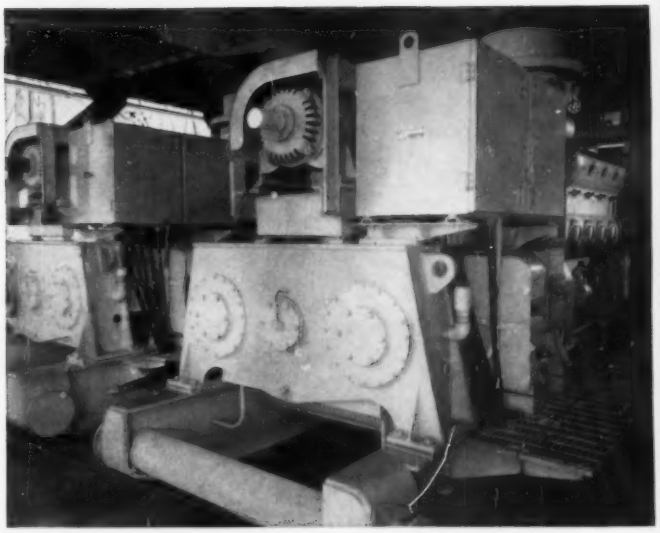
Why is this "one responsibility" important? For one thing, it is assurance that any problems concerning either the engine or electrical components will be handled quickly and satisfactorily—*from one source.*

It means, too, that engine and electrical equipment were designed and manufactured as an integral unit—matched to work better, last longer. It means dealing with only one engineer on installation for the complete power system. And it means one complete facility for all parts and service needs.

Looking at it another way, "one responsibility" is best protection against the extreme cost of downtime. To Gulf Marine with two rigs, the advantages are doubled. Why not ask your Electro-Motive representative about *all* the advantages of Electro-Motive Power?

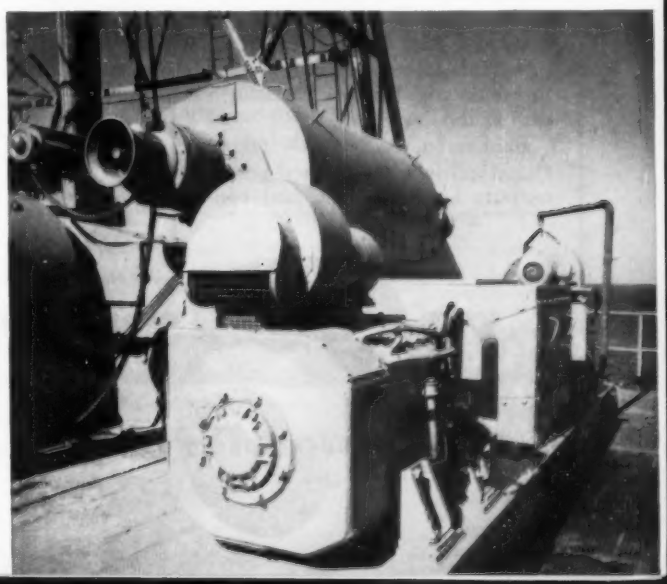
ELECTRO-MOTIVE DIVISION
GENERAL MOTORS • La Grange, Ill.

In Canada: General Motors Diesel Limited, London, Ontario
Petroleum industry sales offices: Dallas and Houston, Texas; Morgan City, Louisiana; Los Angeles, California.



Engine sets on the platform are housed in a shed beside the mast. These two are air-cooled. Engine sets on the barge are keel-cooled.

Two drive motors of 675 hp each power the draw works on Gulf Marine's platform. Drive motors and generators on the engine sets are identical except for field windings, a factor that facilitates service and reduces cost.



AIRESEARCH TURBOCHARGERS
add power to new
ALLIS-CHALMERS CRAWLER TRACTORS

Giant new HD-21 demonstrates how a turbocharged tractor can make the big jobs easy

AiResearch C-60D Turbocharger

Allis-Chalmers, one of the leading producers of construction machinery, has selected AiResearch turbochargers as standard equipment on their new HD-21 crawler tractors. The engines of these powerful earthmovers develop 225 hp at the flywheel and 70,000 lb pull at the drawbar.

Benefits of AiResearch turbocharging include increased power output; better specific fuel consumption; sea level performance at altitude; lower engine thermal loading; and greatly decreased smoking and noise.

Reliability, high performance and long life have been proved by thousands of AiResearch turbochargers already operating in the field in all types of applications. Being air cooled, they require no complicated plumbing. They need no maintenance between normal engine overhaul periods.

• *Your inquiries are invited.*

BASIC SPECIFICATIONS FOR AIRESEARCH TURBOCHARGERS

MODEL	F-51	C-60	A-60	E-100	B-100
Output—lb/min. (Standard Conditions)	29-51	30-60	38-60	50-100	60-100
Diameter—in. nom.	10.0	11.5	15.25	15.1	15.4
Length—in.	10.5	12.9	16.75	14.7	17.1
Weight—lb.	40.0	95.0	125.0	112.0	135.0

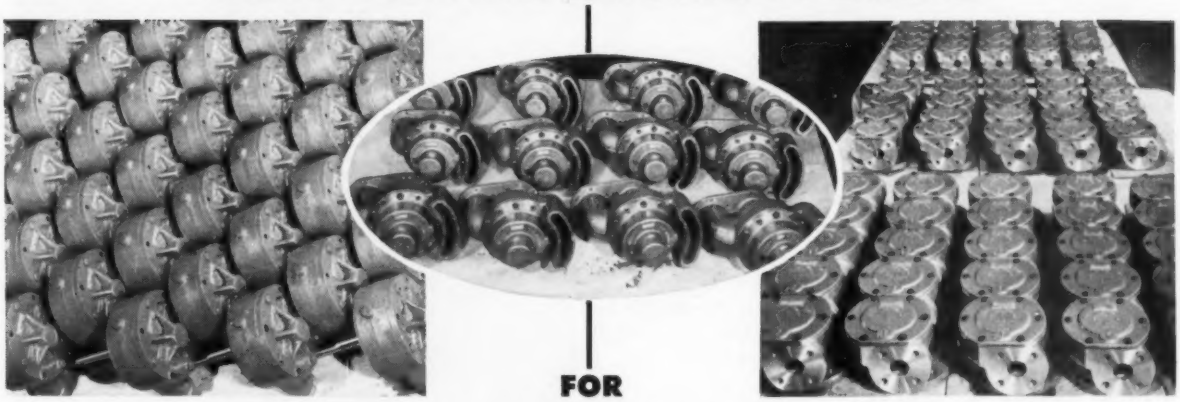
THE GARRETT CORPORATION

AiResearch Industrial Division

9225 South Aviation Blvd., Los Angeles 45, California

DESIGNERS AND MANUFACTURERS OF TURBOCHARGERS AND SPECIALIZED INDUSTRIAL PRODUCTS

NEW TUTHILL BRONZE PUMPS



FOR

Marine Lubrication, Hydraulic Power Transmission, Liquid Transfer and Other Services

Wide Range of Models and Mountings

To meet the requests of the maritime industry, TUTHILL is now supplying a wide range of standard pumps with bronze housing, packing glands, covers and brackets. Here are some of their advantages:

1. MEET GOVERNMENT SPECIFICATIONS
TUTHILL Bronze Pumps fulfill government specifications for marine service, including shock resistance and other advantages of bronze construction. In addition they offer the rugged durability provided by steel gears.

2. PROVEN DESIGN
They incorporate TUTHILL's well known, rotary positive displacement pumping principle which has proved so effective in the solution of industrial pumping problems.

3. SPECIAL AUTOMATIC REVERSING FEATURE
If desired, these Bronze Pumps may be furnished with TUTHILL's special *automatic reversing feature*... which permits the pumps to maintain constant direction of flow, delivering from the same port regardless of direction of rotation of the driving shaft.

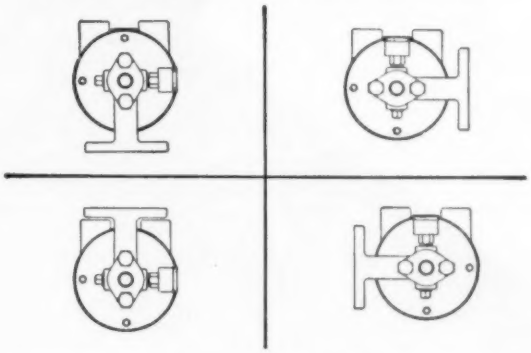
4. BACKED BY EXPERIENCE
For 30 years, TUTHILL pumps have been recognized for outstanding DEPENDABILITY, EASY MAINTENANCE AND LONG SERVICE.

5. ONE YEAR WARRANTY
TUTHILL Pumps carry a specific one-year warranty against defective material and workmanship.

6. FITTING THE PUMP TO THE NEED
TUTHILL policy is based upon "*fitting the pump to the need*" ...rather than "fitting the need to the pump".

7. CUSTOM ENGINEERED DESIGNS
The answer to your pump problem is very probably included in TUTHILL's extensive range of standard designs. However, if your requirements are of such an unusual nature that a standard model is not applicable, TUTHILL's engineers will work with you in developing a new design custom-tailored to your requirements.

TYPICAL ALTERNATE MOUNTING STYLES



New Catalog and Pump Guide Available

A new informative TUTHILL Bronze Pump Catalog is now available. It includes:

1. An "Operating Characteristics" Guide for *all* TUTHILL Bronze pumps.
2. Descriptions of typical model types.
3. Performance curves and other information.

For your copy, fill out the attached coupon—or write

TUTHILL PUMP COMPANY
945 E. 95th Street, Chicago 19, Ill.

Gentlemen:

☐ Please send your new catalog and pump guide on the Tuthill Bronze Pump line.

☐ Have your representative call.

NAME_____ TITLE_____

COMPANY_____

ADDRESS_____

CITY_____ ZONE____ STATE_____

Tuthill Manufactures a Complete Line of Positive Displacement Rotary Pumps in Capacities from 1 to 200 GPM, for Pressures to 600 PSI, Speeds to 3600 RPM.

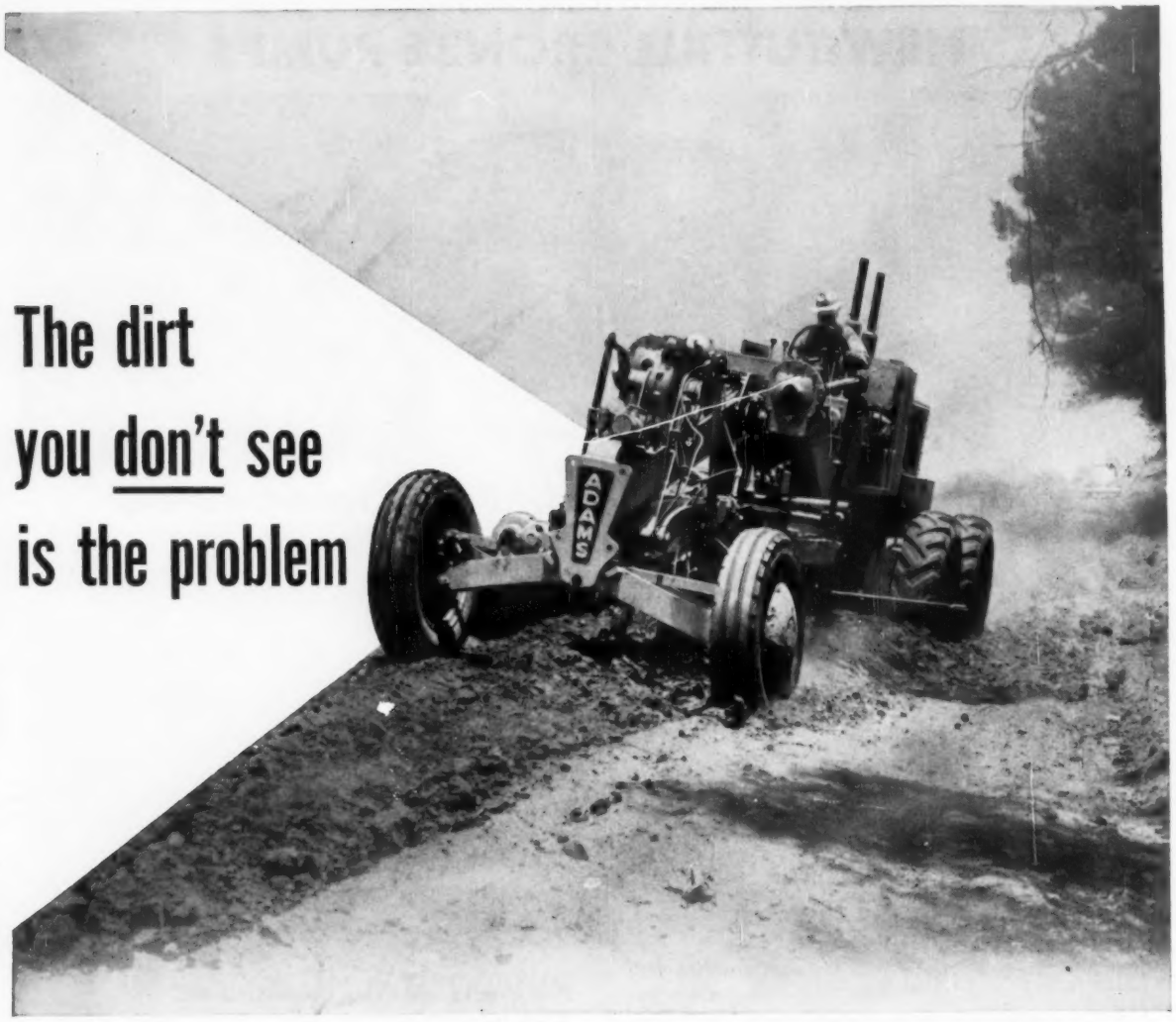
TUTHILL PUMP COMPANY

945 East 95th Street, Chicago 19, Illinois

Canadian Affiliate:
Ingersoll Machine & Tool Company, Ltd., Ingersoll, Ontario, Canada

PUMPS FOR YOUR PURPOSE

The dirt you don't see is the problem



Le-Tourneau-Westinghouse Adams "660" Grader, powered by 150 H. P. Diesel Engine

Dry Type Micronic® Air Filtration solves it

The tons of dirt this grader moves in a day don't give it any trouble at all. But just let a little of the dirt that's drawn in with the air intake get through to the engine and it'll stop dead in its tracks. That's why efficient air filtration is so vital to the operation of this equipment . . . why engine and equipment manufacturers have accepted PurOlator's new Dry Type Micronic® Air Filter as the most efficient yet developed.

Whether your engine is idling or revving at top speed, this new Purolator Air Filter removes 99% of all contaminants. That makes it virtually impossible for harmful abrasives to get into the precision parts of the engine no matter how dirty the job or where you're working. The Dry Type Micronic elements save time and effort in servicing, too. Elements can be replaced in one-tenth the time — and with one-tenth the effort — needed to service other types.

Purolator Catalog AFC-56 contains a valuable chapter "Facts about engine air requirements" that can help you prolong engine life and reduce repair bills. Send for your free copy today. Address Dept.

Filtration For Every Known Fluid

PUROLATOR

PRODUCTS, INC.

Rahway, New Jersey and Toronto, Ontario, Canada

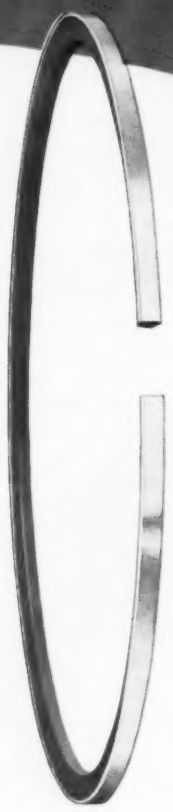
editorially speaking

Spectrum of Power

There's a line from an old song that goes "The music goes 'round and 'round and it comes out here." Swap "power" for "music" and you have today's power field. You need the guided tour. A while back, when someone said "prime mover" you had a clear mental picture of how and where you got your power. But reciprocating engines have gone through several mutations caused by rotating machinery research. Engineers are talking "power systems" rather than clearcut prime mover types. Today, we have a spectrum of power systems. At one end we have the old workhorse, the unsupercharged up-and-downer; at the other end, the pinwheel. That each has something to offer is shown by the way their features are combined in the in-between areas. Moving from the normal engine toward the gas turbine, you pass through the varying degrees of turbocharging. Power in all cases is taken from the crankshaft. In the center is the least-explored area, the compound engine, with power obtained from both crankshaft and turbine shaft. Examples are seen in the aircraft field in the Curtiss-Wright turbo-compound engine and in Napier's "Nomad" engine. Now, Napier is compounding their "Deltic" engine with startling results. Moving over in the spectrum, there's the free-piston, reciprocating gasifier feeding a turbine. Like the combustor-type gas turbine, all power comes from the turbine shaft.

There's the spectrum. Which is the engine of the future? Well, here's an analogy. When radio arrived, they said the victrola was through. Then came television and both radio and movies were supposed to head for the showers. Yet they are all still around and prospering. Why should the power field be any different? There is a job area where each type is best suited and will be used. Growing demands for power will make room for all types. And new characteristics open up new markets. For instance, a lot of engineering went over the drawing board before diesels were light and small enough for truck use. Now, installations are multiplying like Asian flu cases. So with the whole power field moving fast, think in terms of power systems and you'll have a whole spectrum from which to select the best one for you.

This ring gives the diesel user more service, less maintenance . . . truck, locomotive, earth-moving, stationary, or marine



Sealed Power Cyclan plus Chrome Piston Rings

Cyclan plus chrome in Sealed Power diesel piston rings positively defeat excessive heat, breakage, side-wear, friction and corrosion in any application. These unique rings break in fast—and last, and last, and last.

Sleeves and sleeve assemblies from the world's most experienced manufacturer

Sealed Power built and staffed an entire plant solely for the engineering and manufacturing of sleeves. It's the world's largest.

Sealed Power has more know-how, more experience to draw on in this highly specialized field. And the products prove it.

All diesel sleeves and sleeve assemblies are designed and manufactured with extreme care. They are matched for top performance and subject to rigid Sealed Power quality controls.

SEALED POWER CORPORATION • MUSKEGON, MICH. • ST. JOHNS, MICH. • ROCHESTER, IND.
DETROIT OFFICE • 7-236 GENERAL MOTORS BUILDING • PHONE TRINITY 1-3440

Sealed Power Piston Rings

PISTONS • CYLINDER SLEEVES

Leading Manufacturer of Automotive and Industrial Piston Rings Since 1911
Largest Producers of Sealing Rings for Automatic Transmissions and Power Steering Units

highlights

Caterpillar Tractor expects 1957 sales volume to be moderately ahead of last year, thanks to a good first half.

Nickel can now be safely considered for long range plans. According to C. M. Schwitter, market research manager for INCO, increased world production and research assures more-than-adequate supply.

Radiation won't faze bulldozer operators thanks to unique pressurized cab developed by Army Engineers at Fort Belvoir. Made of lead and weighing about 5000 lbs, the cab will allow early clean-up operations of radioactive areas should nuclear war come.

FPC has authorized natural gas facilities costing $616 million during fiscal year just ended. This means 6800 more miles of pipelines and 350,000 more compressor horsepower.

Two-way radios, so helpful in RR operations, are also in the flow of progress. Now transistorized, the new models by Motorola require no external converters or vibrators.

Diesel tractors produced in August totaled 4998. Gasoline tractors accounted for another 11,089 and only 776 were LPG's.

Army officers are making a 12-month "ground-up" study of civilian motor transportation. On-the-spot review of management and operational procedures is on the "campus" of Pacific Intermountain Express.

AAR reports 26,937 diesel-electric locomotives now in use. There are just 3037 steamers left in this country and 611 electric locomotives are in operation. New orders for diesel-electrics total 395. No steam or electric locomotives are on order.

Farm equipment business will wind up better this year than last, Allis-Chalmers predicts. More farmers are realizing one sure way to beat the cost-price squeeze is to cut production costs with modern, versatile equipment. Another contributing factor is the buying boost brought on by the break in the big drought.

Atomic energy in form of beta rays from a radioisotope gauge is used by Delco-Remy Division, GM, to assure uniform thickness of microporous rubber separators for their batteries.

July truck tonnage is up 7.3% over 1956— best gain reported this year by American Trucking Associations. This also represents a 1.3% boost above the June volume hauled.

ARBA and AGC have teamed up for speeding the highway program. A joint plan for action is now being worked out.

Underway is a "Terminal Design Guide". Trucking heads, ATA and AIA members and other professionals are preparing this complete manual for motor freight terminal construction.

Patterns for transportation will change. The ATA urges truck management to take a long look at new business potentials when St. Lawrence Seaway is opened in 1959.

You can't buy distilled water as cheap as motor fuel. Foot-weary Sun News (Sun Oil Co.) editors just proved it in a 4-state check at supermarkets and drug stores. Rockbottom price turned out to be 35c for a gallon of the water plus bottle deposit. After hours comment—club soda costs more per gallon than diesel fuel, too.

Twenty cents of every highway contract dollar will go for equipment purchases and repair parts. However, some curtailment of this huge estimated sum may occur unless better methods of paying contractors are worked out. Monthly payment delays and retained percentages freeze nearly 10% of contractors' earnings.

Sales of all distillate fuels are on the up and up. Since 1952 there's been a steady uptrend each year—a whooping 28.85% cumulative increase. Diesel fuel did even better in this five year period with a 30% boost in sales. To single out just two categories—use of diesel fuel by railroads went up 31.6% and on-and off-highway machines consumed 60% more diesel fuel in 1956 over 1952. All these and other healthy fuel figures were reported by Petroleum Division, Bureau of Mines.

Breaking-In Rebuilt Engines

Rebuilt engines should be broken-in. But how? Contact with engine builders and survey of other sources of information show this to be a controversial subject. Here is a summary of leading view points and ideas to consider in arriving at satisfactory procedures.

ENGINE break-in is a complicated problem. Different materials used in engine building and specifications which differ from one make engine to another are major causes. Mechanical factors, varying speeds and loads, supercharging, etc. are also factors making it impossible to get a simple answer to the problem.

The break-in problem is commonly interpreted as the procedure under which the engine is run after it's assembled until it can carry safely full-rated load at full-rated speed with acceptable lube oil consumption.

There are no specifications of time, technique or materials used for break-in that cover *all* types of engines with *all* designs and *all* materials. But in each case, stabilized friction and proper lube oil consumption must be obtained through a controlled wear-in process of the rubbing surfaces. This refers primarily to cylinder walls, pistons and rings but also includes valve gear and bearings.

The "Wear-In" Problem In General

The wear-in process starts from the condition of the rubbing surfaces as they come from machine tools. These surfaces have microscopic "mountains" which must be worn off and a burnish generated on them.

The first step is to rub off the tops of the mountains while preventing microscopic welding between mountain peaks of mating rubbing surfaces. Since this welding results in scoring of cylinders, pistons and rings, this first phase of break-in must be accomplished with sufficient gentleness to minimize these dangers.

These facts from a letter by O. D. Treiber, consulting engineer, Hercules Motors Corp., make many interesting points. Note first, that there is no discussion of the need for break-in—this is a foregone conclusion.

We are warned, however, about the dangers of generalizing on the subject; given an interpretation of what constitutes acceptable break-in; and the mechanics of break-in are explained. To emphasize the first point, we state flatly: "Follow the manufacturer's recommendations."

Despite this unequivocal statement there's a lot to be said, particularly since our approach was to go to the manufacturers for their recommendations and comments. The objective was to find if a pattern would emerge and if any common precepts would apply. They did. But there are also controversial areas and out-and-out exceptions. These also will be noted.

Ring Seating—The Prime Target

All rubbing surfaces in a new or rebuilt engine require mating during the break-in process. However, all information at hand indicates that ring seating is the major and most exacting requirement. The procedures followed to get this will be generally adequate to protect other rubbing surfaces during the critical break-in period. This does not imply that other rubbing surfaces can be neglected, be sure to check them—it's just that ring seating is the major target.

Until ring seating and good sealing of the combustion space occurs, the following conditions will be noted:

1. Compression will be low, combustion poor and smoking can be expected.
2. Blowby will be high and will be reflected in high crankcase pressure.
3. Lube oil consumption will be high since all rings play a part in oil control.

All these conditions suggest basic indices that may be used to determine when break-in is satisfactorily completed and the engine ready to accept full service.

Let us discuss the views of a cross-section of the high-speed diesel engine industry on modern engine break-in procedures and when an engine is considered broken-in. Some of this data was obtained from a survey made by DIESEL POWER of leading high-speed diesel engine manufacturers as well as oil and piston ring companies. Also, some of these recommendations and opinions were given at a "Lubrication of Rebuilt Engines" symposium conducted by the Automotive Engine Rebuilders Association.

As previously mentioned, the first phase of break-in must be accomplished gently enough to reduce welding process dangers. Rubbing surfaces shouldn't be subjected to excessive pressures and temperatures.

On the other hand, there's a limit to how gentle you can be during this initial break-in period. For example, idling for long periods often results in cylinder wall glazing before the rings seat properly. This glazing, due to low combustion temperatures and incomplete combustion, results in short engine life, high lube oil consumption and loss of

power. Results from another angle are warranty costs and dissatisfied customers.

To avoid these undesirable conditions the engine should be always run-in under load. If possible this should be a controlled load such as with a dynamometer.

Factors Controlling Break-In

It's obvious that modern engine break-in practices are different from those formerly used and between engines of different makes. Tabulated results of the DIESEL POWER survey of leading high-speed diesel engine manufacturers bear this out.

Judging from these charts, it's clear that there are no standard run-in specifications which apply to all engines. Some manufacturers use under-load tests with dynamometers, others don't. Some use special oils, some use the same oil used during normal engine operation. Some manufacturers recommend hastening break-in with mild abrasives under certain conditions whereas many forbid it.

Under-Load Break-In—And, of course, there's the all important matter of how much to load an engine and for how long. This is a problem whether using a dynamometer or not. As seen on the accompanying chart, these figures vary—but one thing is certain—more and more engineers concerned with engine break-in favor quick under-load run-in. Generally, a break-in procedure of this type processes an engine so it is suitable for immediate service on the job.

In those instances where a dynamometer is not available, the operator must in some measure duplicate the break-in procedure. When this is the case the operator must use moderate loads and operate the engine under light-duty conditions generally for at least the first oil change period. An accompanying chart gives typical run-in time.

Lube Oils for Break-In—Field studies conducted by the AERA seem to indicate that highly-additive detergent oils slow down ring seating resulting in high oil consumption or excessive blowby immediately after the overhaul. And unfortunately, these conditions do not improve. In the case of excessive blowby, top-ring sticking develops and contributes to early engine failure. Where there was high oil consumption, all parts, including the rings, still showed the original tool marks when the engines were disassembled.

The majority of the AERA shops contacted were of the opinion that this ring seating problem can be prevented by using an oil with a small amount of additive during the wear-in period. After say about 1000 miles or equivalent hours, this break-in oil could be replaced with a heavy-duty detergent oil if necessary.

These AERA studies also pointed out however, that there are some highly-additive oils which do not give difficulty in ring seating. It is concluded then, that if the types of additives responsible for the trouble can be determined and in what concentration they become critical, this problem can be solved.

On the other hand, many authorities, Mr. A. M. Brenneke, of the Perfect Circle Corp., for one, say that if a run-in problem with high additive oils does exist, they are not aware of it. They have never seen any clearcut, factual data proving that such a problem exists. He feels that slow engine run-in results blamed on high-additive lube oil are based on improper comparisons, opinions and impressions, not on factual data.

This is definitely a controversial area. But one thing is certain, whether use of high-additive oil results in slow break-in or not, it often must be used for protection of some engine parts and therefore you have to live with it.

Other factors must also be taken into consideration in

Pattern for Break-in

Tabulated results of survey gives a pattern of average speeds, loads and time intervals for dynamometer break-in of high-speed diesels. As in any statistical survey, there are exceptions. So follow manufacturer's recommendations whenever possible.

% of Max. Governed Speed	% of Max. Load*	Time in Min.
30 - 40	0 - 10	5 - 15
50 - 60	25 - 50	30 - 60
70 - 80	50 - 75	45 - 180
90 - 100	75 - 100	30 - 240

*Load is percentage of the maximum normally carried by engine (taken from engine hp curve) at the particular speed used.

Load & Speed—First step is to warm up engine at about high idle with no load. Near end of warm-up, engine may be lightly loaded. Speed and load are increased at intervals when engine proves it can take it. Engines not ready to take increased loading safely will show abnormal water and oil temperatures. Other indices are lube oil consumption, crankcase pressure, and exhaust color. All should be watched carefully and if abnormal, speed and/or load must be reduced, or engine even stopped.

Different combinations of load and speed within the ranges given for each step can be used. A portion of the total time can be used for each combination. For example, engine may be run for 10 min at 50% speed with 25% of normal load at this speed; same speed, 35% load for another 10 min; 60% speed, 40% of normal load at this new higher speed for 15 min; and 60% speed, 50% load for 15 min. Total run-in time in this case is 50 min.

If any engine distress is noted as speed and/or load are increased, revert to lower values until engine can accept the new conditions. Engine is often stopped between cycled runs to torque cylinder head nuts and make other necessary adjustments.

Time Cycles—Time range shown is broad for two reasons: (1) Some engines take longer to run-in than others because of differences in design and materials used; (2) Engines are sometimes run-in for a short time on a dynamometer with reliance on final break-in being done in the field. Engine is restricted to moderate loads for a period of field operation until it is completely broken in. A high total run-in time may be sum of series of short runs as loads and speeds are cycled.

Note—Dynamometer break-in is preferable. Broad pattern for this type run-in is given above. When dynamometer is not available, these conditions should be duplicated as closely as possible under actual operating conditions.

due fairness to lube oils. Slow run-in can be and often is due to mechanical factors. For example, piston ring combinations and types definitely have a bearing on ring wear-in. So does the condition of ring grooves. Liner contour, bore finish and how accurately the liner is assembled to the cylinder head (resulting in possible liner distortion) also control break-in speed.

Another mechanical factor must be watched when judging break-in by lube oil consumption. Rings may be seated, yet oil consumption may still remain high. In this case oil is probably being lost from the system in other ways, for example, through excessive valve stem-to-guide clearance.

Abrasives for Quick Break-In—Under certain conditions, some engine manufacturers, Caterpillar Tractor Co. for one, recommend that a fine abrasive such as Bon Ami be used to accelerate the wear-in process if necessary. According to Caterpillar instructions, if lube oil consumption doesn't drop to a normal figure in 200 to 300 hours under average operating conditions, or in 400 to 500 hours under light load, an abrasive should be used.

Bon Ami, a diatomacious earth in fine powder form, is introduced slowly into the intake system just below the air cleaner. Only a specified amount is used depending on the size of the engine. After running the engine with no load at 800 rpm for 30 minutes Caterpillar considers it ready for normal service.

The use of mild abrasives is approved by some other engine manufacturers but generally only as a last resort. In a talk before the AERA, Mr. Lindsley, service engineer, Waukesha Motor Co., suggests that under a very difficult wear-in condition, before the job is given up, it might be tried. If used, it may be done in the following manner. Make an aspirator out of a piece of ¼ or 3/16-in. copper tubing and a "tee" fitting. With a relatively modest size engine, say 400 cu in., use a half-teaspoon of Bon Ami.

The long end of the aspirator is inserted into the intake manifold. A paper trough with a small quantity of Bon Ami in it feeds into the "tee" opening. A finger is placed over the open end of the "tee" fitting. Whether air enters with the Bon Ami or through the open end of the "tee" fitting can be controlled by opening and closing this open end with a finger. Run the engine about 30 minutes with abrasive going in very slowly. Then drain the crankcase, flush it and change the filter.

This can be done in much less time if necessary, according to Mr. Grunder, manager of fuels and lubricants development, Richfield Oil Corp. In his talk before the AERA symposium, he said that just a thimble full of 500-mesh silicon dioxide can run-in rings in a few minutes.

His objection to the use of Bon Ami is that at least twice as much must be used since half of it is a powdered soap and the remainder a coarser grind of silicon dioxide. The tendency seems to be to overtreat an engine and when using Bon Ami, the soap portion is driven into the back of the top ring groove where it forms a fillet. This eventually forms the basis for deposits which force the top ring hard against the cylinder wall and cause excess wear and ring breakage.

ENGINE MAKE	Lube Oils Used During Break-In		Use of Abrasives For Hastening Break-In	
	Oil Other Than That Used In Normal Operation*	Normal Operating Oil	No	Sometimes
Buda		X	X	
Caterpillar		X		X
Cummins	X		X	
Detroit Diesel (GM)	X		X	
Harnischfeger (P & H)	X		X	
Hercules	X		X	
International Harvester	X		X	
Mack	X		X	
Waukesha	X			X

*In most cases normal type of oil is used but of one or two viscosity grades lower. Mack is one exception—a special break-in oil is used for in-chassis break-in with chassis idle.

Many engine manufacturers don't approve of this use of abrasives for wear-in of piston rings. General Motors Corp., Truck and Coach Div., for example, issued a service bulletin specifically forbidding use of abrasive compounds to break-in their rebuilt truck engines. Another engine manufacturer, Cummins Engine Co., Inc., opposes use of abrasives for break-in because of possible damage to cam lobes and valve lifters.

When Is The Engine Broken-In?

In some cases, certain manufacturers consider a new or rebuilt engine broken-in by the amount of lube oil it uses during a specific period of time or by the color of its exhaust smoke. Others judge by the amount of crankcase blow-by. Some manufacturers say that although there is a correlation between crankcase blow-by and ring seating, there are no accurate figures available, with which to judge these engines. Still others check and use all of these indices to determine when the engine is broken-in.

Summary

For details of the DIESEL POWER survey listing each manufacturer's specific break-in recommendations, check all of the accompanying charts. Note the major points on which the majority agree: 1. Controlled break-in. 2. Fast, under-load break-in. 3. Certain operational cycles produce best results. 4. Use of lube oil consumption as the basis for determining when engine is broken-in.

Unfortunately, there are still many differences of opinion at the higher levels as to the relative importance of various factors affecting break-in. Engine manufacturers, ring manufacturers and oil companies are continually involved in research and are cooperating to solve these break-in problems. However, until this situation is further clarified, your safest bet is to follow the manufacturer's specifications.

Metallurgy Makes the Difference

Today's high-output engines are a tribute to the design engineers—and their too-often silent partners, metallurgists. These are heat engines and sooner or later (mostly sooner), you run into temperature and pressure problems. Then, it's up to the metallurgist if the engineering concept is to work.

by: **FRED G. SEFING,**
Development and Research Division, The International Nickel Company, Inc.

"THEY don't build them like they used to." Quite right—and it's a good thing. Without the intensive development work of the last decade or so, diesel engines would be in a poor competitive position. Instead, advances on a broad front have maintained and even improved the diesel's position as the most efficient prime mover around.

New engineering concepts have produced engines of higher power and longer service life. Yet weights and cubages per horsepower are lower. Fuel consumption has also been improved and the engine's appetite for different fuel broadened. Today, the diesel is a more flexible "tool" for the user.

To get these results, design engineers needed more flexible "tools" too—better metals to meet the mounting challenges of increasing internal temperature and pressure. Here's where the metallurgist comes in. And here are some of the cases where metallurgy has come to the rescue.

Turbocharging

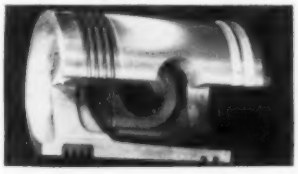
Turbocharging is rapidly increasing both in new units built, as well as in the number of existing units converted. It is a major contribution to todays high power outputs. A suitable capacity turbocharger can increase the engine horsepower up to 100 or 120% over that of the naturally-aspirated engine. Obviously, this power increase develops problems associated with the higher temperatures of combustion and the exhaust gases, as well as mechanical problems requiring metals with greater strength.

Some problems associated with increased heat and pressure in the cylinder and in handling hot exhaust gases in the manifolds and turbocharger will be discussed. Changes in design and suitable selection of metals may be necessary to meet these requirements.

Where engines have little excess air at full rated load, a turbocharger may be applied just to supply a modest amount of additional air to the cylinders for better combustion. Increased power ratings in the order of 25 to 30% can be realized without imposing any particular mechanical or heat difficulties.

With a higher degree of turbocharging, however, a power increase of 40 to 120% can be realized. With a 40% or more increase in power, the higher temperatures of combustion and of the exhaust gas, plus the greater mechanical stresses on the pistons, heads and cylinders, often require some changes in design. Also, metals with higher strength and/or better resistance to heat are demanded. The higher stresses can result from the greater mechanical load to be carried as well as from the greater thermal gradients due to the higher temperatures.

To understand the greater requirements of engine parts subjected to these increased demands of power and heat, let's examine some of the basic effects of turbocharging on them.



Pistons

A piston should be light in weight to minimize inertia forces of higher speeds. This suggests use of reduced section thicknesses of cast iron. In order to reduce weight of an iron piston, however, the metal's strength should be increased, indicating the use of ductile iron (see Table I) or possibly steel. The greater castability and machinability of ductile iron indicates its preference to steel castings.

Since higher piston temperatures result from increased speeds and greater amounts of fuel burned, adequate piston cooling becomes more critical. Effective cooling

TABLE I. PROPERTIES OF SOME CAST METALS

Material	Tensile Strength psi	Yield Strength psi	Hardness BHN	Elong. %	Mod. of Elong. Million psi	Thermal Cond. cgs. units	Thermal Expansion Millionths per °F 68 to 1000°F	Stress to Rupture In a 1000 hr psi
Ductile Iron Type 80-60-03	80,000 to 100,000	60,000 to 75,000	200 to 240	3 to 10	24	0.0741	7.4	800°F 30,000 to 40,000 1200°F 2400 - 2900
Cast Iron	40,000 to 50,000	—	230 to 260	nil	16 to 18	0.11 to 0.12	7.5	—
Ni-Resist								1000°F
							Type 1 10.7	10,000
	25,000 to							1200°F
Types 1 & 2	35,000	—	125 to 170	—	12 to 16	0.095	Type 2 10.3	3800
	30,000 to							1200°F
Type 2B	37,000	—	140 to 180	—	15 to 16.5	0.095	10.3	4000
	25,000 to							1200°F
Type 3	35,000	—	120 to 160	—	15 to 15.5	0.094	8.7	4000
Ductile Ni-Resist								
	58,000 to	32,000 to						1000°F
Type D-2	65,000	36,000	140 to 180	8 to 20	16.5 to 18.5	0.032	10.4	30,000
								1200°F
								12,000
	58,000 to	33,000 to						
Type D-2 B	70,000	38,000	160 to 200	7 to 15	16.0 to 19.0	—	10.4	—
	57,000 to	33,000 to						1100°F
Type D-3	67,000	37,000	130 to 170	7 to 18	13.5 to 14.5	—	8.7	28,000
								1300°F
								10,000
Stainless Steel								
								1200°F
Type HF	80,000	45,000	170	35	28	0.037	9.9	17,000

is imperative because metals lose their strength rapidly as the temperature rises above some critical point. For cast irons, ductile irons and steel, this temperature is about 800°F and for aluminum alloys it is about 400°F.

Above the critical point, light-weight aluminum alloy pistons will tend to pound the compression ring grooves to a greater width thus permitting "blow-by". This causes loss of power and burning of the piston. Also, when an area of the piston head is subject to overheating because of uneven combustion or fuel impingement, collapse is likely to occur.

It has been found that ring groove pounding and piston head burning can be prevented by mounting suitable inserts made of heat-resistant high-expansion metals such as Types 1 or 2 Ni-Resist* cast iron or 18-8 stainless steel (see Table I and 3). Use of 18-8 steel for ring bands, however, is not usually pratical due to the need of wear resistance between groove and piston rings. These high-

TABLE II—Ni-Resist In Engine Liner Service

	Material	Duration of Service	Average Cylinder Wear	Cylinder Corrosion (Water Side)
1	Porous Krome Cast Iron	3000 hr	0.008	General corrosion and pitting occasionally through wall.
	Ni-Resist, Type 2 (160Bhn)	2500 hr	0.009	No corrosion, slight discoloration.
2	Gray Iron (250Bhn)	35,000 — 50,000 mi	0.0075	Bad corrosion with pitting often through cylinder wall.
	Ni-Resist, Type 1 (150-170 Bhn)	100,000 mi	0.0015	No appreciable corrosion, slight pitting.
3	Gray Iron (220 Bhn)	50,000 mi	19 to	Standard cylinder block.
	Ni-Resist	50,000 mi	1	Ni-Resist cylinder insert in gray block.
4	Ni-Resist	2,000 hr	0.0005	Full liner in aluminum block.

No. 1—Heavy-duty truck diesel engine hauling ore from pit.
No. 2—Heavy-duty truck diesel engine trailer road service, West Coast.
No. 3—Taxicab and light city bus service.
No. 4—Light-duty, high-speed engine, air-cooled.

TABLE III—Heat Resistance Data

Alloy Composition		Oxide Penetration Rates (inches per year[1]) Test 1	Test 2	Test 3
Plain Gray Iron	None		0.8	
Grate Bar Iron	0.50 Cr, 1.3 Ni		0.8	
Stove Iron	1.0 Cr. 1.0 Ni		0.23	
FB-A Iron	0.90 Cr, 1.9 Ni		0.28	
Type 1 Ni-Resist	14 Ni, 6 Cu, 2 Cr		0.18	
Type 2 Ni-Resist	20 Ni, 2 Cr	0.27	0.16	
Type 2B Ni-Resist	20 Ni, 5 Cr	0.006	0.07	
Type 3 Ni-Resist	30 Ni, 3 Cr	0.078	0.08	
Type 4 Ni-Resist	30 Ni, 5 Cr, 5 Si	0.003	0.002	
25-12 HR Steel	25 Cr, 12 Ni	0.003	0.0	
Ductile Iron	2.5 Si			0.015
Ductile Iron	5.5 Si			0.0015
Ductile Ni-Resist Type D-2				0.019
Ductile Ni-Resist Type D-2C				0.04
Ductile Ni-Resist Type D-4				0.0015
Conventional Ni-Resist Type 2				0.038
Stainless Steel Type 309				0.0

[1]Oxide penetration measured microscopically at 25X.
Test 1—Electric furnace air atmosphere, 1375-1400°F, 3723 hr.
Test 2—Electric furnace air atmosphere, 1400°F, 2000 hr.
Test 3—Furnace atmosphere—air, 4000 hr at 1300°F.

expansion Ni-Resist inserts are commonly bonded to aluminum alloy pistons by the Al Fin** process and have proven excellent expedients to prevent aluminum piston failures.

*Reg. Trade Mark
**Patented by Al-Fin Div., Fairchild Engine & Airplane Corp.

Liners

Rubbing of piston rings on liner walls with minimum lubrication requires a high order of wear resistance of these parts. With increased speed and supercharging, the wear problem becomes exaggerated. Quality of cast iron liners can determine the degree of wear resistance. Foundries supplying liners today have learned better methods of founding and structure control to afford longer wearing qualities.

Increasing pressures, however, are requiring higher liner strengths and higher speeds are developing undue vibration of the walls. This vibration can be suppressed by stiffening the design or using a stiffer metal. Higher strength and greater stiffness demands with good wear suggests the use of wear-resistant ductile irons with up to 80,000 or 100,000-psi tensile strength.

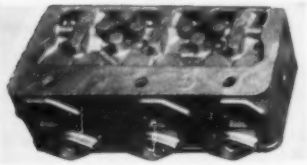
In some engines frequently stopped and started, excessive "wear" occurs in the upper part of the liners. We feel that this is corrosion. When the engine is cold condensates attack the metal and the piston rings removing the corrosion product. An engine running with few cold starts, usually shows fairly even wear over the ring travel, as compared with those engines frequently started that show excessive wear at the top 20% of ring travel. Also, with certain fuels and in some service conditions, service corrosion of cylinder walls becomes excessive.

Effects of these frequent starts, corrosive fuels or other corrosive conditions can be prevented by use of corrosion-resistant metals which maintain the same degree of wear resistance as gray iron. Ni-Resist ductile iron has demonstrated excellent resistance to corrosion and wear, as shown in Table 2.

Where, however, pitting corrosion on the water side of the liner wall is encountered, it is more likely to be cavitation erosion, a result of vibration, rather than simply corrosion. In such a case, use of Ni-Resist irons can improve the situation but it will not entirely eliminate it.

Piston Rings

A piston ring, well fitted to the cylinder wall and having a high order of wear resistance, will give an amazing account of itself. Use of high-strength cast irons as well as chrome plating for higher surface hardness and superior wear has become common piston ring practice. Because of increasing loads on the rings with resulting breakage tendencies, higher strength and toughness are indicated. This again points toward use of wear-resistant, high-strength ductile iron of over 80,000-psi tensile strength and with some toughness to withstand high firing impacts.



Cylinder Heads

Increased power per cylinder causes higher temperatures and pressures of the gases under the head. There are also marked differences in temperature between portions of the head. Resulting thermal stresses can become high enough to cause rupture. For example, a temperature difference of 100°F between different areas of a cast iron head can develop stresses in the order of 11,000 or 12,000 psi.

These thermal stresses, plus other stresses from high combustion pressure and those from improper head-bolt torquing, can easily exceed ultimate strength of the cast iron. The remedy, then, lies in effective cooling and use of stronger irons such as ductile cast iron. An alternative is use of a metal with much higher heat conductivity to keep the temperature differentials at safe levels. Proper design to accomplish uniform and effective cooling of the head is of great importance.

Valves and Valve Seats

High temperature requirements of valves and valve seats subjected to the hot exhaust gases is a highly specialized study. Although special heat-resisting alloys are used, the increasing combustion temperatures pose greater difficulty in meeting the service requirements of a gas-tight seal.

One problem is associated with the valve "plucking" out particles from the valve seat. This is evidently a type of welding of these seat particles to the valve. This soon develops uneven seating and, of course, leaking valves. Careful selection of special metals to resist heat, pounding, wear, etc., becomes more important with the degree of turbocharging applied.

Valve Guides

When exhaust gas temperatures increase to the degree that cast iron or bronze valve guides are burned, a more heat-resistant metal offering good wear properties against the valve stem is required. Long successful experience of Type 1 Ni-Resist valve guides in aircraft engines meeting just these conditions indicates the practical use of Ni-Resist valve guides in diesel engines. If design is such, therefore, that guides are exposed to exhaust gas heat, inherent wear resistance at high temperatures and resistance to the heat itself of Ni-Resist Types 1 and 2 make these metals especially suited to valve guide service.

Exhaust Manifolds

As degree of turbocharging is increased, exhaust gas temperatures go up. Manifold temperatures can reach about 1450°F with the greatest amount of turbocharging. Gray cast iron can perform satisfactorily up to temperatures of about 1100°F. Above this temperature, however, resistance to heat of gray iron becomes inadequate. Furthermore, when temperatures of about 1250°F or more are reached, the metal undergoes a change of structure accompanied by volume changes as it heats above and cools below this critical temperature. Cracking or warping of cast irons results from these structure-volume changes.

Turbocharger application for power increases of 25 to 30% may cause a manifold temperature of the order 1000 to 1100°F. This is usually handled with conventional cast iron manifolds. With power increases of 40% to 100%, however, manifold temperatures generally rise to 1250°F and up to 1450°F. At these temperatures, cast iron's resistance to heat is no longer adequate.

A more heat-resistant metal is required. Certain chromium-nickel steels or Ni-Resist irons Type 2 or 3 meet these metallurgical requirements. Since Ni-Resist alloys are readily cast into manifold sections, they have been found practical and economically serviceable. See heat resistance data—Table 3.

Selection between Type 2 or Type 3 Ni-Resist depends upon expansion requirements; Type 3 has a lower thermal expansion than Type 2 and it is therefore preferred for certain designs. Use of proper slip joints is frequently used to accommodate expansion of manifolds at high temperatures.

Where manifold service demands high strength and toughness at 1200 to 1450°F, Ni-Resist alloys can be obtained in the magnesium-treated or ductile variety. For example, stress rupture properties of ductile Ni-Resist alloys types D-2, D-2B and D-3 are of the order of three times that of conventional flake graphite Types 2 or 3 Ni-Resist. When high vibratory mechanical stresses are encountered or when heavy parts are mounted on the manifold, one of the ductile Ni-Resist types with its high

strength and toughness at the service temperatures have withstood the service.

Turbochargers

A turbocharger is a small simple gas turbine whose shaft is common with the air compressor. The turbine consists mainly of a housing, nozzle ring, hot wheel and shaft. These parts are exposed to the exhaust gas temperatures, excepting the shaft, this is generally protected and cooled by the air-side of the assembly.

Power to drive the compressor is developed in the hot wheel running at high speed (in smaller models, 40,000 to 80,000 rpm). Special gas turbine alloys are used for the turbine blades. These metals have sufficient strength and resistance to heat and erosion for the gas temperatures encountered.

The turbine casing requires a metal with properties similar to those of exhaust manifolds. Types 2, 2-B or 3 Ni-Resist have met the need. Generally, high structural strength at maximum operating temperatures is required of casings. Its hot-gas intake flange often supports the entire weight of the turbocharger. Plus the weight, shock loads must be considered.

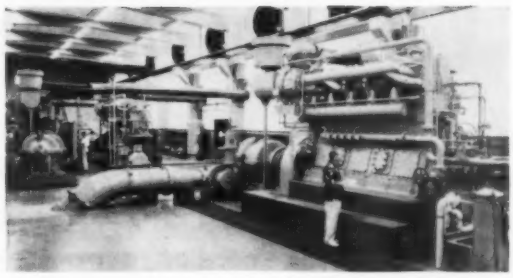
The high strength at service temperatures of Ductile Ni-Resist types D2, D-2B or D-3 are indicated. The readily-castable Ni-Resist alloys with selected expansivities at moderate or high strength and toughness levels (see Table 1) have shown economical and practical service life.

If a nozzle ring is included in the design, it may be made of the moderate strength Ni-Resist alloys. Plus being stationary, its mechanical requirements are not too great.

Summary

This discussion has been confined to those engine parts exposed to combustion gases and the exhaust of turbocharged engines. Possible changes in design have been indicated and the most practical metals suggested to handle the severity of service with different degrees of turbocharging. The temperature and pressure problems yield to a sensible analysis of the service needs, careful engineering and selection of suitable metals.

This discussion also serves to alert the man in the field. Engine builders have in varying degrees availed themselves of these techniques and materials. They are probably incorporated in your engine. Speaking of the metals and their uses, be sure that they go back into your engine in the replacement parts that are used. It can mean a lot of difference in service life.



Rigid Service Schedule For Miami Pumps Pays Off

JUST three years ago, the City of Miami installed four of these turbocharged Worthington 825-hp, 450 rpm diesel pumping units in its Alexander Orr, Jr. Water Treatment Plant. Operation and maintenance men report they didn't have to replace a single piston ring, cylinder liner or bearing because of wear during the first two years. The engines have run over 32,000 total hours without one forced shutdown or failure.

Roy Wine, maintenance superintendent, credits much of this operational record not only to the reliability of the engines but also to the strict inspection and maintenance schedule in effect since the units went on the line. He has kept a careful account of each engine's performance since the initial start-up. Here are the interesting statistics totaled for both 1955 and 1956.

Engine No.	Total Hrs. Operated	Fuel Oil	Lube Oil	Oper. & Maint. Material Costs
1	6,438	150,802	836	$ 820
2	8,218	213,932	1,474*	981*
3	9,156	241,931	2,053	1,310**
4	8,292	205,305	1,167	1,465
	32,104	811,970	5,530 gal.	$4,576

* Includes 190 gal oil change. ** Includes rings replaced before needed to avoid possible shut-down.

Water pumped totalled 16,019 mg. Total costs including fuel, lube oil, operation and maintenance material costs came to just under $5.68 per million gallons.

Speeds of the pumping units can vary from 405 to 450 rpm to serve water demand conditions. Water output can go from 8 mgd to 18 mgd, depending on head and rpm, without overloading the engine. Ability to operate between 405 and 450 rpm allows the plant to vary output from 8 mgd up to 64 mgd in infinite steps.

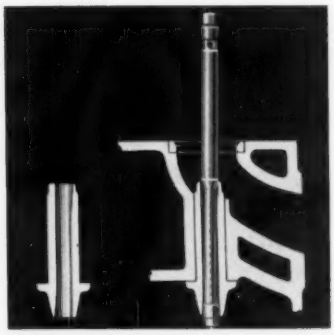
This plant has proved its reliability. Generator equipment integrated with the diesel units has brought power savings on peaking service.

Valve Jobs Can Be Better

A good valve job means attention to detail. Here are some of the major points to watch. Success of the next job—and the next, and the next—may well depend on how well you take care of your equipment on this job.

By: MILO C. GRAY

President & General Mgr., Hall-Toledo, Inc.



With worn guides, valve stems generally follow worn area. Here, taper at pilot top and expanding collet at bottom center pilot in worn area. Seat is then reconditioned to new axis established.

GETTING good service between valve jobs? Even if you think so, go over the following tips. Chances are that they'll help you improve your valve service life.

Valve seating is a precision job. The closer that you can reproduce the correct geometry of the related parts, the better your chances of long service life. It boils down to attention to detail during the job and use of good equipment, kept in good condition.

Valve Guide Axis—The Benchmark

Everything starts with the axis of the valve guide bore; it is the center line from which the whole geometry of the system is figured. So start by checking the condition of the guide bore.

Clean the bore with a spring-type guide scraper or with a wire brush. Get rid of all deposits that could give you false indications. Check the bore for wear and straightness. Valve stem wear can tip you off to unusual conditions. A fairly common type of wear results from misalignment, perhaps introduced in an earlier job. An off-center seat has caused the head to move laterally resulting in guide wear at one side on the top, on the other side at the bottom.

You'll never get a really good seating job with a bad guide. It pays to be critical and replace questionable ones. Take the case mentioned. The valve stem will tend to follow the worn path and if the reworked seat has been centered on the unworn portion of the guide, the valve head will hit on one side first and slide into closed position.

Our pilots are built to center on the worn portion and the seats are reconditioned accurately in relation to this new axis. Good seating will be obtained but there is no question that a new guide and a properly concentric seat will produce a better, longer lasting job.

Use the right pilot. This means not only the proper size but also the proper length. We recommend that the portion of the pilot within the guide be at least 1/8-in. shorter than the full length of the valve stem-guide contact area and preferably not less than two-thirds of this length.

Several types of pilots are available. We have standardized on the expanding-collet type. But selective fit wring-in plug pilots are available. Whatever type is used, the fit should be tight and the areas of contact such that the axis of the bore and the pilot coincide.

Cleanliness is very important, not only for the job you are doing but for the ones you'll do in the future. The presence of abrasive materials is inherent in the job. Imagine the effect of installing a plug-type pilot in a guide bore with abrasive particles either in the bore or on the pilot. So clean the bore and the pilot thoroughly.

The upper end of the pilot provides the bearing around which the seating stone rotates. Since seat runout is usually limited to 0.001 to 0.0015 in., a good fit is essential. With full seat contact-type grinders, stone rotating speeds are high. With our point-contact method of grinding, rotation of the eccentric shaft on the pilot is very slow—only 15 to 20 rpm. Yet chance of harmful pilot wear is present.

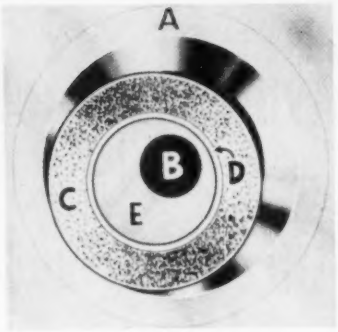
We allow a clearance between pilot and eccentric shaft of 0.0001 to 0.0002-in. If wear increases this to 0.001-in., the seat when ground may be unacceptable. This illustrates the importance of frequent and thorough cleaning of the pilot and grinding mechanism. This is the only way to insure good tool condition for a long series of jobs.

Grinding Wheel Care

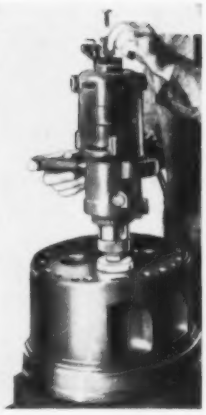
Your finished seat should have a fine finish, should have the right seat angle and be the proper width. Start by taking care of your stones. When grinding dry, the wheel should be free from oil, grease and dirt. A good way to clean them is by first soaking them in high-test gasoline, then mounting and running them on the grinder to throw out the loosened material.

Dress the grinding face carefully. Set the proper angle on the dresser and with the grinder running, pass the diamond back and forth across the wheel. Use a light feed, a thousandth of an inch or so, since excessive feeds are very hard on the diamond. Diamonds are brittle and the shock of taking a deep cut may crack them.

Don't take off more of the stone than necessary. As soon as you get a clean sharp surface, stop. The condition of the seat, the amount of roughing to be done, and even the



Principle of Eccentric Grinding—Larger model eccentric-type valve seat grinder is shown at right in position for seat reconditioning. Cross-section looking down on valve set (A) is at left. Pilot (B) is fitted in valve guide bore. Stone (C) is rotated at correct grinding speed by hollow shaft (D) around inner or eccentric shaft (E). This shaft in turn is rotated around pilot (B) at 15 to 20 rpm. Due to off-center hole location, axis of eccentric shaft orbits around axis of pilot. Thus, grinding stone has point contact with the valve seat and as the eccentric shaft turns, contact point progresses evenly around seat.



material will determine how often redressing is necessary.

On old seats, be sure to clean all carbon and scale from the seat and the adjacent port area. Clean the seat with gasoline to remove grease and oil. Keeping foreign materials away from stone saves trips to dressing stand.

Roughing is rarely required when grinding using the eccentric method. However, if roughing is to be done, two grinding wheels may be best. Otherwise, a good practice is to give the wheel a fresh dressing just before final finishing. Then, without redressing, rough out the next seat.

Proper seat width is important. Follow the engine builder's recommendations. Valve heads cool during periods of seat contact and it would appear that cooling would be better with wider seats. Perhaps so, but difficulties in getting a perfect seal, no matter how accurate the work, increase as seat widths are widened. On the other hand, if seats are too narrow, valve cooling suffers.

Regrinding will widen the seat. When too wide, narrowing stones are used—a 30-deg wheel on 45-deg seats, 15-deg wheel on 30-deg seats. Narrow from the top to keep the seat diameter correct. Otherwise, it will contact the valve face out where metal sections are too thin.

If you've done the job right, a valve seat dial indicator will show little or no runout. Finish, angle and seat width will all be right.

Now, the Valve

Valve refacing is no problem; it's not like working from the intangible axis of a hole as in the case of the guide. The whole valve should be cleaned. The stem is checked for wear and for straightness. Heads are checked for cracks. Whenever possible, black light inspection to determine non-visible cracks should be used, particularly on the valves for the larger engines. Take a good look at the thickness of the material at the outer edges. When a valve has been refaced before, further refacing may produce a "knife-edge". High-temperature strength of the valve seat may be inadequate and the valve will "tulip" in service.

There are a number of good valve refacers. As in the case of seat grinders, however, cleanliness and a reasonable amount of care are needed to maintain their built-in accuracy. Ground metal and wheel particles are tough on precision equipment. Chucks or collets are subject to wear and damage so keep them clean and treat them with respect.

With the chuck in good condition and the valve stem straight, the refaced area will be concentric with the stem. Set the proper face angle (it may be flatter from that of the seat by ½ to 1-deg to get a ring seal), dress the wheel, check your speeds and feed, and start refacing.

Don't forget to check the ends of the stems for wear or other damage. The keeper grooves too. Most refacers have jigs for refinishing stems. If the groove is damaged, better get a new valve.

Conclusion

If all the steps in this job are done right, the valve and seat should give a good tight seal right from the start. The most it should need is a very light lapping with diesel fuel.

Equally important from the tool owners viewpoint is the fact that by a high degree of cleanliness and care, his machines are in shape to do many more good jobs.

The user benefits because the job has the best chance of lasting for a long time. The job was done with precision and the intended geometry of all the parts was retained. Understandably, we feel that the highest degree of precision in seat regrinding is obtained with our machines that are based on the principle of point-contact grinding.

In all other types of grinding, this is the accepted standard. Why not for this job? In our machines the stone is driven at 10,000 to 12,000 rpm on an axis offset from that of the pilot. An eccentric mechanism rotates the axis of the wheel in an orbit around the pilot. Thus the stone (smaller in diameter than the seat being ground) makes only point contact with the seat. A micrometer feed-mechanism brings the grinding wheel into the high spot of the seat 0.001-in. at a time until the seat is concentric.

The procedures outlined apply to valve jobs on both small and large engines. Similarly, our seat grinders apply to the same range. The models EJ and the larger EDP are suitable for valve seats from 1 to 6-in. diameter.

Model 40, White Superior diesel rated 360 hp at 900 rpm fits in Manitowoc 4500 shovel with ample space for easy maintenance. Large removable panels permit quick access to all internal engine parts.

White Diesel Direct Drives Shovel Crane

Inherent demand of shovel-machinery drive is filled by slow-speed heavy-duty, high-torque diesel with excellent results.

Manitowoc 4500 shovel crane dumps rock, clay and slate onto spoil pile. A 60-ft boom with 45-ft stick gives this 4-yd rig the necessary reach to dig against a wall of overburden 70 ft high. Shovel moves almost 400 yd of overburden per hour with ease.

SHOVEL cranes inherently call for slow shaft speed, high-torque drive for their machinery. Where simple direct drive is desired, low-speed, large-displacement, high-torque engines are most suitable and give excellent shovel performance.

The White Superior Mod. 40 diesel is typical of the type of unit used for direct driving a shovel crane. This 900-rpm, high-torque unit, for example, is being used as original equipment on Manitowoc 4500 shovels. It is also used on shovels of other makes. Its fully-bedded crankshaft, individual cylinder heads, individual injection pumps and other features of accessibility make this a true heavy-duty engine.

From the standpoint of labor fatigue and routine maintenance, this vertical, in-line engine allows plenty of room for quick and easy maintenance. Full enclosure of engine insures freedom from dirt and dust. Large removable panels permit quick access to all internal parts for inspections, adjustments, or repair.

Its simplified vertical design makes fewer replacement parts necessary. Fuel consumption is low. Its open-chamber combustion system enables the engine to operate exclusively on non-premium fuels.

For a first-hand example of what and how one superior powered Manitowoc shovel is doing in the field, let's visit

the Terramana Brothers Coal Co. job site in Steubenville, Ohio. Here you'll find a new Manitowoc 4500 digging in against a wall of overburden 70 ft high with ease and operating economy.

A 60-ft boom with a 45-ft stick gives the shovel the necessary reach to dig the embedded rock, clay and slate from the sidewall and deposit it on a spoil pile of about the same height.

The 4-yd rig moves almost 400 yd of overburden per hour in one of the most efficient stripping operations from a time and cost standpoint in the company's history. Company officials estimate production costs on this job to be almost 20% less than that of previous equipment used on similar jobs.

For Terramana, this reduction in stripping costs came about through an extensive study of primary operating problems prior to final selection of the unit. Operating costs were climbing gradually and stripping costs had to be reduced to maintain a profitable mining operation.

Furthermore, experience showed that operating a shovel with minimum cost in repairs and overall maintenance depended to a great extent on design characteristics of the unit and design and capacity of its power plant.

With this in mind, the brothers studied the factors controlling maximum shovel output at minimum operating and maintenance costs. After considerable deliberation the Manitowoc 4500 was selected as the unit most suitable for the job.

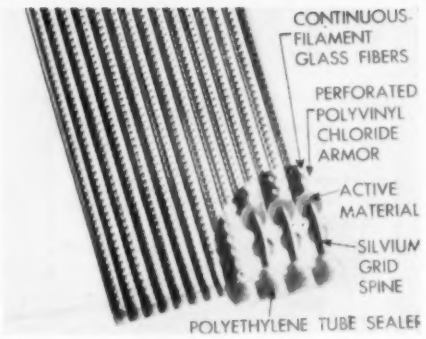
Horsepower—A Factor

Satisfied that the shovel has the necessary stability, maneuverability and design characteristics to give economical operation, the company concerned itself with the source of power.

A foremost consideration was selecting a power plant capable of delivering sufficient horsepower to permit the engine to operate without strain under the most adverse digging conditions. They were looking for "true" horsepower, that which is rated under actual operating conditions and not under ideal conditions which rarely exist in the field.

According to Albert Terramana, an operator's misconception as to engine horsepower rating can result in excessive operating and maintenance costs. "All too frequently," he says, "it has been necessary to operate a shovel engine at its maximum power to bite into heavy overburden. This 'wide-open' type of operation greatly increases costs and frequently causes shovel breakdown due to working strain."

In selecting the White Superior engine for their rig, the continuous conservative horsepower rating of 360 proved more than adequate. The engine has sufficient horsepower and torque to enable the shovel to take a healthy bite from the overburden and swing back to the spoil pile at a speed near that of idling. This ease of operation, due to adequate horsepower, is a decided factor in the overall operating economy of the unit now in service for two 10-hr shifts every working day.



New Cranking Battery For Diesel Locomotive

A NEW locomotive diesel cranking battery was recently introduced by Exide Industrial Div. of The Electric Storage Battery Co. It gives more power per cu in. and per dollar than their former models.

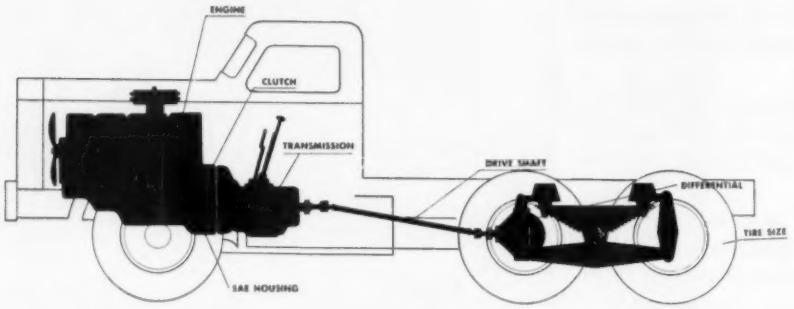
The MGD Exide-Ironclad is said to combine high-rate cranking and standby performance with long-life. This is done through use of armored porous tubing encasing the grid splines and active material of the positive plates. Also by use of other improved components within the basic tubular-type plate design.

A 50% increase in amperes discharged at diesel cranking rates is obtained over the present Exide tubular-plate type battery. In a size normally furnished for switching locomotives of 600 to 1200 hp, the new MGD battery delivers power equal to batteries now used in road locomotives of 1200 hp and higher.

One reason for this high discharge-rate is the extreme permeability of the armored porous tubing for diffusion of electrolyte and passage of current. The tubing acts like a highly-efficient filter, facilitating electrochemical action. It is made of continuous-filament glass fibres within a perforated polyvinyl chloride armor and prevents practically any loss or shedding of active material.

Although porosity is extremely high, openings are so minute that no particles can pass through. Thus, more efficient use of space within the battery is made and high capacity is preserved throughout its life.

The new MGD Exide-Ironclads are engineered and designed for saving on maintenance. High electrolyte level prolongs intervals between waterings. Side reinforcing bands of the molded rubber containers provide ventilation between battery units and prevent accumulation of dirt and moisture. Heavy ends and side walls plus reinforced corner construction of the container protect the battery against damage in service.



Location of transmission in relation to the other parts in the drive system shows one reason why it's important to get one of the correct size. Wrong one won't fit in available space.

Get the Right Transmission

for Replacement
for New or Repowered Applications

The "right" transmission for your job means proper capacity and correct assembly. Whether you get it or not can depend on how well you have told your story to the transmission manufacturer.

By: Luther Butler — Ass't. to General Sales Mgr., Fuller Manufacturing Company

A TRANSMISSION can't just be ordered. You've got to give all the facts. Whether transmissions are ordered for use with a new engine or for replacement purposes, detailed information on the specifications of the truck chassis or machine in which the unit is to be installed should always be provided in full. Otherwise, the transmission manufacturer is confronted with the problem of identifying both capacity and construction of the transmission. If transmission capacity is not correct it will not function properly. If its physical features are not correct it can't be assembled in the chassis.

Functional Details

In connection with the capacity of the transmission, the manufacturer needs the following information:

1—Make and model of engine
2—Maximum torque and horsepower output
3—Reduction ratio of driving axle
4—Tire size on both driving and steering axles
5—Gross weight of truck or combination of tractor and trailer
6—Type of service

The first two items give the manufacturer the data he needs to determine the maximum torque that the transmission must handle—hence the torque capacity required. Knowing this, plus the data from the remaining items, he can figure out the gear ratios required to take care of the type of service.

The transmission must permit proper over-the-road speeds without either engine overspeeding or lugging. The ability to maintain correct engine rpm-to-vehicle road speed through an appropriate range of gear selections is essential for both best possible performance and for engine protection.

The information covered above as well as other pertinent facts about the chassis can be given on a vehicle-specification sheet such as that shown.

Physical Details

The replacement transmission must correspond to the basic specifications of the engine, clutch, parking brake, and universal joint arrangement. This is particularly important in a truck because all these units are usually retained in the vehicle when the transmission is changed.

Normally, the construction of the transmission is resolved on the basis of the answers to the following questions.

1—What is the distance from the friction surface of the clutch flywheel to bolting face of the engine flywheel housing? This dimension is required to identify the length of the clutch release bearing carrier so that both complete release and complete wear-in of the clutch can be secured. (In Fuller units, release mechanism can be furnished for standard push-type, single and two-plate clutches such as those built by the Lipe-Rollway Corp., Borg and Beck Div. of the Borg-Warner Corp., and the Rockford Clutch Div. of the Borg-Warner Corp. Release mechanism for single and two-plate, pull-type clutches, such as those built by the Spicer Div. of the Dana Corp., must be secured from the clutch manufacturers.)

If all the information requested on this specification sheet is given to the transmission manufacturer, he will have no problem identifying both the capacity and construction of the transmission for your unit.

The Following Spaces to be filled in by Chassis Manufacturer

Firm Name

Address

Date

Person With Whom to Correspond

His Position

1. VEHICLE MODEL NO.

2. NO. OF WHEELS & TYPE OF DRIVE—*Indicate by "X"*

Four-Wheel Chassis ☐	Six-Wheel Chassis ☐	Two-Wheel Drive ☐
Four-Wheel Drive ☐	Six-Wheel Drive ☐	Track Drive ☐

3. TYPE OF VEHICLE
(Use separate sheet for each if more than one)

Highway Operation—	Tractor ☐	Truck ☐	Grader ☐
Off-Highway Operation—	Tractor ☐	Truck ☐	Scraper ☐
Steel Rail Operation—	Locomotive ☐		Rail Car ☐
Fire Apparatus ☐	Bus ☐		Taxi ☐

4. TYPE OF SERVICE (Make notations to indicate special types of service, such as mining, logging or bus for urban, interurban, school, etc.)

5. ENGINE
Make and Model

No. Cylinders Bore Stroke
Cu. In. Displ. Maximum Torque Lbs. Ft. at R.P.M.
Maximum Horse Power at R.P.M.
GOVERNED SPEED R.P.M.
FLYWHEEL HOUSING S.A.E. No.

6. TYPE OF TRANSMISSION DESIRED
Mounting—Unit ☐ Amidship ☐ Both ☐
Controls—Center ☐ Forward ☐ Remote ☐

7. REAR AXLE GEAR RATIO

8. TIRE SIZE
Rear Single Rear Dual
Front

9. CHASSIS WEIGHT
Without Cab or Body

10. GROSS WEIGHT
Truck or Bus Total Tractor and Trailer
Other Types

11. WEIGHT ON DRIVING WHEELS

12. PEDAL SHAFT
Left ☐ Right ☐
Dimension from centerline of transmission to end of pedal shaft

13. For PLATE CLUTCH Installations:
Distance from friction surface of flywheel to flange of flywheel housing

Make and Model of Clutch (*specify number of plates*)

14. IF IN PRODUCTION, Clutch and Tranamission used

15. NOTATIONS or additional information

2—What is the make and model of clutch to be used?

3—Will parking brake be required? If so, identify the type, make and model. If band-type brake is of Fuller manufacture, identify the universal joint companion flange so that the correct drum may be provided.

4—What is the length to which the longer of the two clutch pedal shafts will project from the clutch housing? Pedal shafts of varying length can be provided so that the clutch pedal can be located in the original slot in the floor boards.

5—Will speedometer drive gear or corresponding spacer be used? Spacers corresponding to the length of speedometer gears can be furnished, but speedometer gearing must be ordered from the manufacturer. Speedometer gearing can be identified by the manufacturer only on the basis of the identity of the transmission, the reduction ratio of the driving axle, and the size of the tires on the drive wheels.

6—Is the vehicle of the COE or cab-forward type? If so, a remote control must be used. Normally, each transmission manufacturer provides remote controls adaptable to his transmissions. On this basis, Fuller must have details relative to: (1) distance between the gear-shift lever and the neutral path in the shifting yokes and blocks in the transmission; (2) location of gear-shift lever in relationship to the driver's seat; and (3) the distance from the centerline of the transmission to a point at the side which will clear the clutch and flywheel housings.

7—Does design of the cab require bends in the gear-shift and brake levers? If so, sketches should be provided.

8—What is the SAE size of the engine flywheel housing? The situation in connection with replacement transmissions is complicated by the fact that some truck manufacturers who operate captive engine plants do not adhere to SAE specifications in the design and manufacture of engine flywheels and flywheel housings.

Consequently, only specially-designed transmission equipment normally produced on a tool participation basis can be attached to these engines. Sale of these specially-designed transmissions is usually restricted to the truck manufacturer for which they were designed. Falling in this particular classification are the standard truck engines built by Ford Motor Co., GMC Truck and Coach Div., International Harvester Co., Reo Motors, Inc., and White Motor Co.

Although these concerns build standard truck engines with special flywheels and flywheel housings, SAE standard flywheels and housings usually can be secured at additional cost. Obviously, the installation of a replacement transmission of SAE specifications becomes more expensive when it is necessary to purchase flywheels, flywheel housings and (in many cases) a new clutch in addition to the transmission.

Summary

These are the minimum facts that must be covered when giving the transmission builder data for a replacement unit. Any other pertinent information as well as peculiarities of your equipment must also be included. It's the only way to get the correct replacement transmission for your unit quickly.

RR Diesels Conditioned For Mountains

Long hard pulls over high mountain peaks demand engines to be in top shape. The Southern Pacific shop in Bugene, Ore., puts and keeps locomotive diesels in condition to make the grade.

By: BLYTHE S. HIRST

HOW does a typical railroad handle engine repairs? A tour through the Southern Pacific Co. shop in Bugene, Oregon will give us an idea. This shop is comparable to other large railroad shops except that major locomotive over-haul work is not done here. However, since it is located on Southern Pacific's line running north and south, general engine maintenance and repair on freight units is continual. The long hard pull over the Willamette Pass calls for engines in top shape.

Let's begin our tour through the shop with a unit just brought in for a regular check-over. This unit is powered by an EMD, 1750-hp., vee-type diesel.

Cylinder Pressure Test—First the engine is wiped down. Then an air check is run on each cylinder with a special air nozzle and gauge. With all crankcase inspection covers removed, two men work together, one on each side of the engine. Each tests the cylinders on his side and through the inspection hole examines the skirt of the piston on the opposite side.

With the piston at TDC the air nozzle is inserted in the opening provided and the air valve is opened. The air pressure used is from 90 to 120 psi. Exhaust valve leaks can be heard in the exhaust manifold and piston ring blow-by can be heard in the crankcase.

A leak in the valves or past the rings causes a drop in air pressure. This is shown on the gauge. The air nozzle and test gauge used are of the recommended type for this test. The gauge has two needles, one black and one red. Opening of the air valve causes both needles to rise. When the air valve is closed the black needle remains stationary, but if there is a leak, the red needle drops down.

Cleaning Parts—If the engine is disassembled, the cylinder heads, liners, pistons and connecting rods are steam cleaned. Then the parts are put in a Southern Pacific #233 warm alkali solution for thorough cleaning.

Checking for Cracks—After the parts are cleaned they are magnafluxed and also checked by Zyglow (black light). Since using this equipment, repeat break downs are almost non-existent. Ordinary visual inspection does not reveal small flaws that eventually get larger and break off in pieces. For example, one valve shown looked good but under the black light several small cracks were revealed on the outer edge. The valve was dicarded.

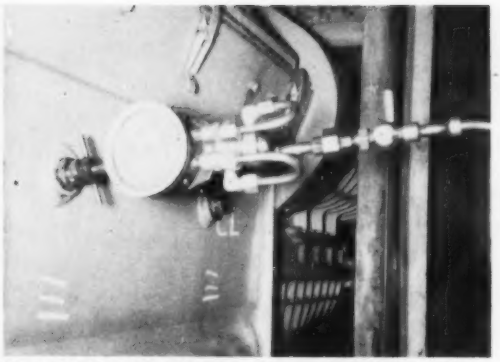
Liner Inspection and Servicing—After liners are magnafluxed they are checked for wear, out-of-roundness, scars and ridge size. The liner is set upright over a light inset in the floor. The full length of the liner is then visible and checking the bore with an inside micrometer is more easily accomplished.

The ridge size is checked and removed by honing if it exceeds the engine manufacturer's specified limit. To complete liner maintenance, all threads on the studs are gone over with a die nut.

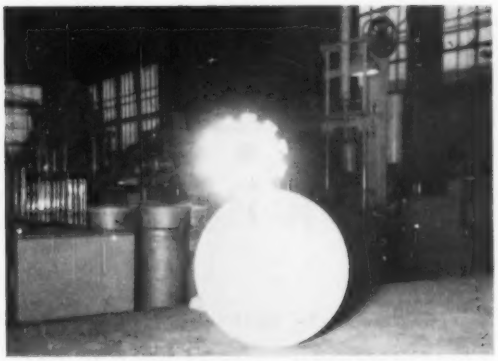
Piston Inspection and Repair—Pistons are thoroughly inspected, especially the ring grooves and lands. A limit gauge is used to determine if larger width rings are necessary. Pistons with worn lands or lands which are step cut are sent to the machine shop for reworking.

Cylinder Head Repairs—The individual cylinder heads used on these engines have four exhaust valves. Cooling water circulates from the liner up through the water passages into the head. All of these openings plus the valve seats are carefully checked by Magnafluxing.

Special shop-built cylinder head-repair stand permits head to be rotated by releasing spring-loaded pawl at left by foot. It's light, but stable and strong.



Special air nozzle and gauge are used to check for leaks in cylinder. Gauge registers any drop in cylinder pressure.



Limit gauge in ring grooves of piston checks wear. Thickness of cogs in gauge show if larger width ring is needed.

Every precaution is taken to prevent the face of the head from getting marred. Heads are transported on special aluminum pallets which have circular insets to hold the heads from shifting.

Southern Pacific has designed and built some special head-repair stands. These are light enough to be moved easily, yet are stable and strong. The stand permits the head to be rotated by releasing a spring-loaded pawl by foot. Proper clearance for head disassembly and assembly and comfortable working height makes for efficient use of this stand and results in much time saved.

Valves and Valve Seat Maintenance—Valves are wire brushed and sand blasted to remove carbon and varnish. They are then given the Zyglow treatment and looked over under the black light. If found to be satisfactory, the valve seats are ground and checked for concentricity with a dial indicator. Seating must be 100% effective. Valve seats and valve faces are ground by a valve refacing and seat grinder. After the valves are assembled in the head they are tested by a vacuum cup for three minutes at a minimum angle of 60 deg.

Connecting Rod Alignment—Connecting rods are put in an aligning jig. A dial indicator mounted on a sliding support is then used to check the connecting rod for bends or twists.

Storage of Serviced Parts—Pistons are matched to the liners for clearances according to the manufacturer's specifications. A complete assembly consisting of an assembled head, piston with rings and connecting rod inserted in the liner, is then stored in a special box. Assembled heads are also placed in boxes. The boxes are tagged to show in which engine the assembly will fit.

Engine Run-In—An engine that has been worked on for heads, liners, pistons and connecting rods is run for about two hours after assembly and then gone over for final adjustments. The unit is then moved from the shop to the test loading station. Test loading is a matter of taking the leads from the generator and hooking them to a series of resistor grinds. The engine is then put through a series of loads similar to normal operation. Any malfunction can be detected and corrected before the unit is released for field operation.

After valves are assembled in cylinder head they are tested with a vacuum cup for three minutes at a minimum angle of 60 deg. Cup has trigger release.

After valve seats are ground they are checked for concentricity with a dial indicator.

Metallizing — A Reclamation Tool

How and why many worn and/or damaged engine parts are being reconditioned by metallizing is explained by Metco engineers. Check your repair work —this process may have some advantages for you.

Leaks at water-seal end of railroad diesel water jacket are eliminated by building up this section by metallizing. Corrosion and wear caused leaks.

REPLACE or recondition? You face this decision each time engine parts are worn or damaged. Your answer will depend on a lot of things—costs, downtime involved, parts availability, life expectancy required, etc. Included in your decision must be consideration of the possible methods of repair, their costs, advantages—and their limitations.

What do you know about metallizing? How does it fit into your kit of "tools"? Engineers of the Metallizing Engineering Co. (Metco) supplied the following data to give you a fill-in on this process with broad application for reclamation of engine parts. Crankshafts, liners, waterjackets, pistons, etc., can be rebuilt by spraying them with molten metal.

It also has many other uses ranging from coating of metals for corrosion resistance to salvaging of mismachined parts. However, it should not be used on parts subject to heavy point or edge impact, or parts subject to high stresses confined to small areas, such as gear teeth, threads, etc.

Metallizing

In this process, wire is automatically drawn through a special gun to a nozzle where it is melted in an oxygen-gas flame and atomized by a blast of compressed air. Metal particles mesh on a previously prepared surface to produce a coating of the desired metal. The air blast keeps the sprayed surface cool, resulting in a "cold" process of building up metal.

Equipment

The equipment necessary includes an air compressor with a minimum capacity of 35 cfm at 70 psi, a drying unit, an air receiver and air control unit. The gas used is generally acetylene although propane can be used plus a source of oxygen. A gas control unit and flow meter, a wire control unit and metallizing gun complete the installation.

The drying unit keeps the air clean and dry. Air pressure is kept from fluctuating during operation by the air-control unit. The gas-control unit maintains the careful regulation of gas pressure necessary. The wire-control unit holds the wire and feeds it smoothly into the gun.

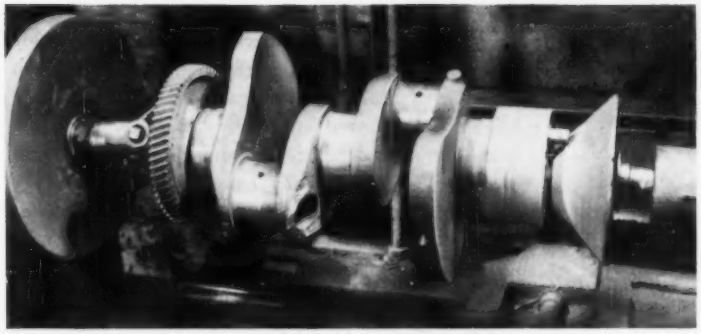
Applications

Four general steps apply for metalizing diesel parts to be reconditioned. These are:

1. Undercut to allow for build up of sprayed metal.
2. Prepare surface by a bonding method.
3. Buildup with sprayed metal.
4. Finish machine or grind to size.

However, when a special part such as a complete crankshaft is metalized other things must be done before following these four general steps. In this case, for example, a crankshaft is first inspected for surface defects, then given a complete dimensional inspection. This includes the measuring and recording of all journal sizes, gear fits, runout of journals, flange faces and pilots, and checking of angularity and parallelism of pin journals. If the shaft is within normal limits for reconditioning it is then straightened if necessary and prepared for spraying. All these steps may not be necessary if only one crankpin or journal is metalized.

Now the above four general steps can be followed. Let's cover these one at a time as they apply to a crankshaft. First the shaft must be turned down enough to give the desired sprayed metal thickness. The sprayed metal coating should be thick enough so that it will not be worn through in service. The feather edge resulting from wearing through the coating would rapidly score the bearings.



Seal contact surface on diesel crankshaft is built up by metallizing and then machined to original size to salvage crankshaft.

Liner at right rear has been sprayed but not finished. Liner at left has been metallized and machined to restore corroded water grooves. Inside diameter of the water jacket in front has been built up with Sprabronze and is ready for machining.

The ends of the undercut should be feather edged. Tapering off the coating thicknesses eliminates hard rings, reduces stresses at the ends and cuts grinding time.

The minimum finished thickness of a sprayed coating is determined by first deciding the maximum wear allowance and then adding to this the minimum permissible coating thickness.

If good atomization is being obtained, a finishing allowance of 0.015-in on the radius for a 1-in diameter shaft plus 0.003-in for each additional inch in diameter up to a maximum allowance of 0.030-in on the radius will be sufficient. In addition to this wear allowance, only 0.002-in to 0.003-in minimum coating thickness of Sprabond Wire (a bonding material) is required plus 0.002-in to 0.003-in of another metal.

If the atomization is course, or if the coating is uneven, an additional finishing allowance should be made to allow for these factors. Where finishing is to be done by grinding, allowances for finishing may be slightly smaller.

Surface Preparation

After the undercut, some form of preparation to obtain a bond is always required. Sprayed metal can be bonded to a base metal by one of three basic methods: 1. Heating the base. 2. Roughening the base. 3. Spraying Sprabond onto a clean base. Of these, the last is the most commonly used in reconditioning crankshafts as well as other diesel parts.

Sprabond, a high molybdenum alloy adheres to smooth, clean metal surfaces. After a very thin coating of this metal has been sprayed, any other metal may be sprayed onto it. Where Sprabond Wire is used, previous preparation is not always necessary because this wire itself is usually considered a bonding and preparation step.

Heating—Bonding by heat alone is seldom used since the high temperatures required in most cases to secure adequate bond may cause warpage and surface oxidation.

Grooving—As for roughening, grooves of some kind should be used in conjunction with any bonding method where coating thickness is over 0.050-in. Also when stress on the bond or sprayed metal will be heavy. For instance, if a heavy coating is to be put on a shaft with a keyway, grooving should be used at least across the keyway. These grooves restrain the metal from shrinking thus preventing loosening of the bond.

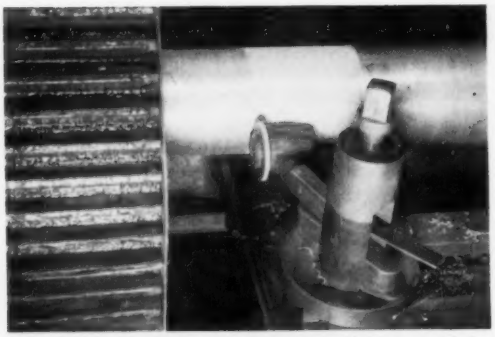
Since in most cases undercutting of the surface is necessary, when done with a dry tool it provides the necessary cleaning for applying Sprabond. Absolute cleanliness is essential.

Masking—Since Sprabond adheres to all smooth surfaces it is necessary to mask areas not to be coated. However, since a very small amount of surface contamination prevents adhesion, masking is easy. Oil or Metco masking compound will protect bare metal not to be sprayed. Masking tape may be used where it is more convenient.

Even a small amount of moisture on the base metal will greatly reduce bond strength. To insure against this, run the flame of the gun over the work rapidly without feeding wire just before applying Sprabond.

Spraying—In spraying, acetylene and oxygen pressures are very critical. Sprabond tends to oxidize and may not bond if excess oxygen is used. Acetylene pressure should be about 15 psi. If it's too high, the Sprabond coating will be too fine for proper bonding with the subsequent sprayed metal. Where a Metco gas flow meter is used the acetylene-oxygen adjustment is very simple. The correct ratio of gas and oxygen is 1-vol of gas to 1.6-1.7-vol of oxygen.

After the shaft is properly prepared it is mounted on centers in a lathe or other turning device. Although it may be held by hand, the gun is usually mounted in a tool post with its nozzle 4 to 10-in from the shaft surface, depending on gun type and wire used. The end of the wire should project beyond the gun air cap as



Shaft with gear on end of it has its surface prepared for metallizing by roughening to form dovetail grooves. To obtain this, Metco's rotary shaft preparing tool is mounted in the tool post with toothed wheel square with the work.

far as possible. It should never be level with or inside the end of the air cap.

The shaft is usually turned at an rpm giving a surface speed of 35 to 100 fpm. If the gun is mounted on the tool post, the traverse should be 1/16-in to ¼-in per revolution. Although it's not necessary to stay within these limits, it's generally good practice to traverse the surface rather rapidly to avoid layer effects.

Machining—After a shaft has been sprayed there is usually a ragged edge of sprayed metal over the shoulders at the ends of the undercut section. Where build-up is heavy, this ragged edge may cause a crack that will penetrate into the main section of the coating. It is good practice to remove this ragged edge by machining or grinding it off before the main finishing is begun.

Grinding—Dumore portable tool-post grinders with suitable wheels are used. They are specifically designed for use on existing shop equipment (lathes, milling machines, planers, shapers, boring mills, universal grinders.) Mounted on any basic machine, these grinders will machine the workpiece and finish-grind it without changing set-up or switching the job to another machine. They are accurate to within 0.0001-in.

All ground surfaces should be thoroughly cleaned after grinding to remove abrasives from surface pores. Thorough scrubbing and rinsing with a suitable solvent will do this.

Polishing—Polishing sprayed metal requires no special skill other than remembering that you're not polishing a solid piece of metal but a thin veneer which is bonded to the base metal mechanically and not by fusion. Using ordinary procedure and equipment, sprayed metal can be polished and buffed to a high luster.

General Advantages of Metallizing

The spraying process produces a number of changes in the metal characteristics from its original form. It has greater particle hardness and a microscopic surface porosity giving good lubricating characteristics due to retention of oil in pores of the metal coating. These generally improve wear resistance of bearing surfaces over parts machined from solid stock.

The high speed and comparatively low cost of metal spraying make possible large savings of time and money in the repair or salvage of parts. Sometimes as much as 90% of replacement cost is saved. The speed factor is particularly important in reducing machine downtime and lost production when replacement parts are not immediately available. In many cases it reduces a large inventory of duplicate replacement parts, eliminates stocking parts for off-standard dimensions and permits salvage of parts no longer made.

Here's a typical case showing how maintenance cost and downtime can be reduced. A large mid-west chemical plant uses 14 gas-engine compressors operating 24-hr a day. Most of these are 300-hp, 8-cyl, 11½-in. bore by 28-in. stroke engines.

Three methods of reconditioning these engines were normally available.

1. Cylinders could be replaced and standard sizes of other components preserved at a cost of $450 per cylinder.

2. Cylinders could be rebored and fitted with oversized pistons and rings at $400 per cylinder. With this method each engine would eventually have different size bores, ratios would be off-standard, and parts no longer interchangeable. Repeated reboring would have made new cylinders necessary eventually.

3. Metallizing at $125 to $150 per cylinder. In this case cylinders are bored out to true-up diameter, rough threaded and grit-blasted to clean the surface and provide a good bond for the sprayed metal. They are then degreased and metallized with 20 to 30-lb per cylinder of high chrome, high-carbon stainless steel. A high finish is obtained by machining and honing to size.

In the first year, 64 cylinders were re-surfaced for a total saving of about $16,000 over the method of reboring and fitting with over-sized rings and pistons and $19,200 was saved over the cost of new cylinders. This is typical of the savings being obtained throughout the industry.

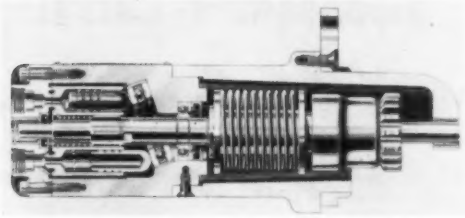
In addition, these re-built cylinders are now good for another 15 years of continuous operation, about 50% more than their original life before re-conditioning. This is possible because of the greater particle hardness of sprayed metal, its better lubrication characteristics, and the superiority of a stainless steel surface over the original cast steel.

Conclusion

Many metallizing jobs such as those discussed plus those illustrated are done in the owner plant by their own maintenance men. Others are done on a job basis by a local metallizing contractor. In case variety and frequency of use do not warrant purchase of metallizing equipment, it's more practical to have an occasional job done by a dependable contract shop.

Metco's factory-trained field engineers make plant surveys to help the company determine which is more economical. They give national-wide service.

American Bosch



HYDROTOR

BOTH the "Hydrotor", a hydraulic starter, and Hydromotive Inc., who developed it, are now owned by the American Bosch Arma Corp. Distributors of American Bosch fuel injection equipment are no doubt eager to add this unit to their line since hydraulic starters such as the Hydrotor have several unique advantages.

Often, these advantages justify the higher initial cost of installing this system. For example, winter starts are easier and surer. This is especially important in extremely cold climates such as in northern sections of the U. S.

To cite one case, on cold days a Minnesota operator used to start one tractor by gasoline engine then use it to push the other equipment for starting. This took several hours, all of which was lost production time. With Hydrotor-equipped diesels he is now able to start all equipment simultaneously.

In hazardous locations such as refineries, oil tankers, magazines, and power boats, use of a hydraulic starter reduces the danger of explosion or fire to a minimum during starts. Since there are no electrical switches, motors or batteries, there's no danger from arcing between contact points or from battery fumes.

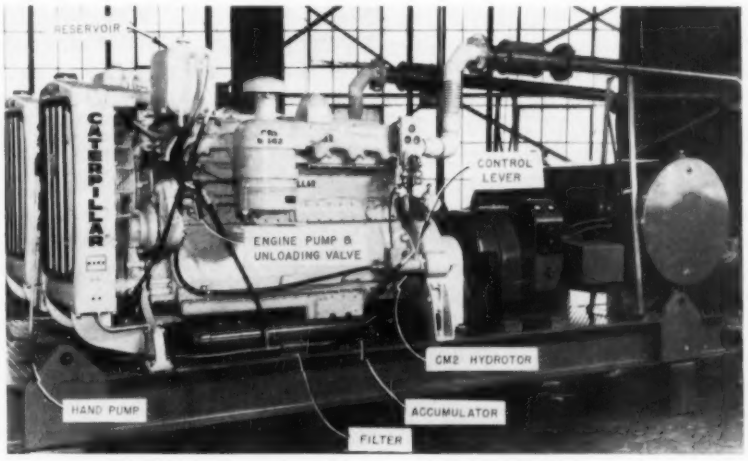
The Hydrotor system is composed of three main units: the starter, a positive displacement hydraulic motor for rotation; a hydraulic pressure accumulator for storing up sufficient pressure for several starts; and a hand-operated or engine-driven hydraulic pump. A hand pump is generally included when engine-driven pumps are used.

The use of a hand-operated pump which permits an operator to build up the necessary hydraulic starting pressure at any time, makes this system completely self-contained.

Choice of a hand or engine-driven pump depends on the needs of the engine operators. For example, operators of diesel motorships might prefer hand pumps since their equipment may be started only once during a trip. On the other hand, bus and truck lines may choose an engine-driven pump as their equipment is generally started many times during a work day.

Simplicity of the Hydrotor system insures dependable operation with minimum maintenance. It is adaptable to many types and sizes of diesel engines.

Because of its safety features in hazardous areas and trouble-free cold weather operation, the Hydrotor system has a large potential market.



A unit rig and equipment-generator drive using twin Model D342 Caterpillar diesel engines shows a typical Hydrotor hydraulic starter installation. All major units of the Hydrotor hydraulic system are labelled.

Neodesha's Latest—Its Biggest

Years of trouble-free operation by five Nordberg diesel generator sets proved their durability. Choice of new large-capacity engine indicates rapid growth of electrical demand typical in diesel-electric municipal power plants.

NEODESHA'S new 3150-hp Nordberg diesel is putting some impressive figures into the record book. But that is nothing new for this Kansas municipal plant. This is the sixth Nordberg to go into the plant and it will take a lot of years to equal records set by earlier units for durability and continuous trouble-free service.

The big 16-cyl, vee-type Supairthermal Duafuel engine was put to work on September 7, 1956, and by April 1, 1957, had run 3313 hours and generated 2,535,000 kwh. Most of this time the engine operated on economical natural gas with a little pilot oil. But during the Winter gas shortage, it worked as a straight oil-burning diesel.

Despite a load factor that averaged a poor 35.5%, the engine had an average fuel consumption of 10,220 Btu per kwh for the 7-month period. As load factors improved a little, efficiencies became much higher. In January, with the gas supply cut off, the diesel ran on oil alone for 417 hours and produced 505,000 kwh while using 32,227 gal of fuel. With this average load of 54% the engine returned 15.6 kwh per gallon of fuel, a very satisfactory figure. This is an average of 8333 Btu per kwh.

The big engine's economy extended to lube oil consumption, too. In the 3313 hours of operation, the 3150-hp unit used 807 gal of lube oil, an average of 12,931 hph per gallon.

With installation of the new unit, Everett Powell, Superintendent of Water and Electric Plants, was able to take his No. 5 unit off the line and check its condition. This engine, a 1750-hp, 4-cycle supercharged Nordberg Duafuel, was put on the line February 14, 1952, and immediately became the base-load prime mover of the plant.

In the remaining 10½ months of that year the engine worked 7014 hr out of a possible 7728. Then it was on the line 8705 hr in 1953, 8726 hr in 1954, 8515 hr in 1955, and 5438 of a possible 5832 hr in the first eight months of 1956, preceding the installation of the new diesel. Thus, for 55 months, the No. 5 Nordberg was on the line 38,398 hr or 96.3% of the time. For the 2-year period 1953 and '54, the engine worked 99.4% of the time.

On February 1, 1957, after 40,431 hr of operation, the engine was shut down for its first overhaul, a preventive maintenance measure. Compression was good. Pistons, liners and rings were clean and in excellent condition. Not a single ring was changed. Valves were ground for the first time. The outboard bearing was adjusted. Actually, no parts needed replacement.

The only parts which Mr. Powell services on a 6-month schedule are the fuel injection nozzles. It is his practice to alternate two sets of injectors, servicing one set while the other is at work. After more than 40,000 hr, no other maintenance was required.

Background

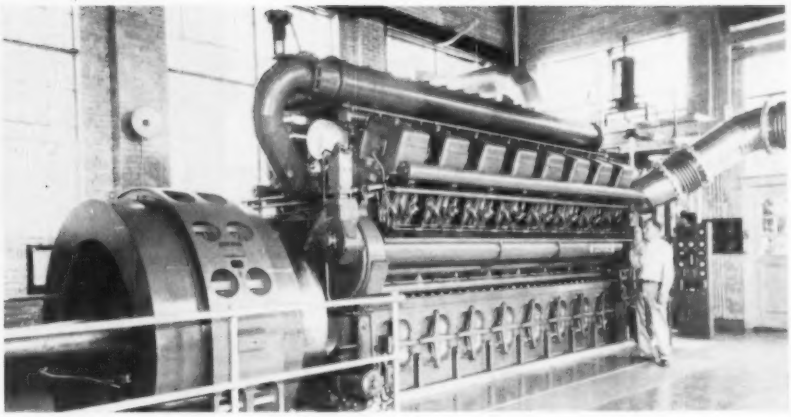
Neodesha engineers were not worried about making this engine work so hard. Their confidence was based on past experience with the plant equipment. The municipal light plant dates back to 1910 and it was 12 years later that the steam engines were replaced by a pair of 550-hp, 2-cycle Nordberg air-injection diesels. These engines met the load requirements for another dozen years.

In 1934, a larger Nordberg air-injection diesel rated 880 hp at 257 rpm was installed. This engine, now designated No. 2, ran 97.8% of the time for 12 years, carrying a variable industrial load. A look at the engine hour meter on January 1, 1957, showed that this unit had logged 116,392 hr of service. Yet it has never been necessary to remove a shim from main or crank bearings of this unit.

In 1946, a 1620-hp, 2-cycle solid injection Nordberg diesel was installed. Two years later it was converted to a high-pressure Duafuel engine and became the first prime mover in the plant to burn natural gas. Then, in 1952, the 1750-hp, supercharged Duafuel unit was installed.

With this engine in almost continuous service, Neodesha planned additional plant expansion. This expansion was necessary to assure reserve generating capacity for this southeast Kansas municipality of 3800 which is both an industrial and a shopping center for a broad belt of wheat, corn, alfalfa and cattle farmers.

As to the type of load carried, an alfalfa dehydration plant provides a heavy seasonal load which combines with air conditioning to make June, July and August the plant's peak months. A nearby Standard Oil refinery is not only a convenient source of fuel oil but an occasional power customer when its boilers are down for maintenance. With the refinery load, the city's plant has carried peaks as high as 2100 kw. However, overall, there has been some decline in industrial load but a rise in residential consumption has given the plant a better balanced and more profitable load.



Superintendent Everett Powell inspects the Supairthermal Duafuel 3150-hp unit —largest in the plant. Control panel in background has pyrometers, alarm panel, various gauges and push button controls for the auxiliary pump motors.

Latest Plant Addition

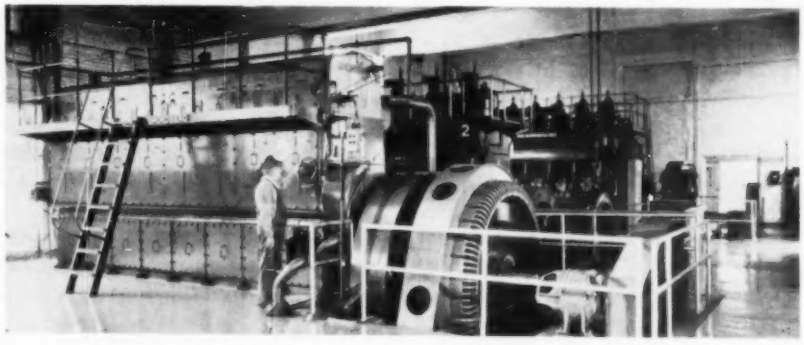
To carry out the necessary plant expansion, the two original 550-hp engines were removed to make room for the new unit rather than build an extension. Progress in engine design made it possible for the new 3150-hp diesel to fit in the space occupied by one of the 550-hp units, leaving space for still another big engine. This new vee-type, 16-cyl, supercharged Supairthermal unit develops its rated horsepower at 450 rpm and drives a 2812-kva, 2250-kw, 3-phase, 60-cycle, 4160/2400-v generator.

Complete accessory equipment serving the engine includes a full-flow lube strainer, cellulose catridge lube bypass filter, an activated-clay filter on the plant fuel supply in addition to fuel filters on the engine, an oil-bath intake air filter, and lube and jacket water heat exchangers with automatic thermostatic valves. Automatic controls switch the engine to straight oil operation if the gas supply fails and shut the engine down if pilot oil fails. A gauge board near the engine holds exhaust pyrometers, an alarm panel, and push-button controls for auxiliary equipment.

A new operating schedule for the plant will provide better load factors. The big No. 6 engine will run 24 hr a day through the Summer months, probably all the way from May 1 to November 1. The other units will be added if the refinery calls for power. The Winter loads will be carried by the 1750-hp No. 5 unit with help from smaller units as necessary. The result is certain to be even greater economy for an already profitable plant.

Principal Plant Equipment

Engine	3150-bhp, FSG-1316-HSC, 16-cyl., vee-type, Supairthermal Duafuel Nordberg Mfg. Co.
Alternator	General Electric Co.
Turbocharger	DeLaval Steam Turbine Co.
Fuel Oil	Stanolex, Standard Oil Co. (Ind.)
Plant fuel filter	Honan-Crane Corp.
Engine fuel filters	Wm. W. Nugent & Co., Inc.
Lube oil	Standard Oil Co. (Ind.)
Full flow lube filter	Purolator Products, Inc.
Bypass lube filter	Hilliard Corp.
Oil cooler	Young Radiator So.
Auxiliary lube pump	Geo. D. Roper Corp.
Air filter	Cycloil, American Air Filter Co.
Exhaust silencer	Maxim Silencer Co.
Jacket water pump	Allis-Chalmers Mfg. Co.
Heat exchanger	Young Radiator Co.
Thermostatic valves	Amot Controls Corp.
Gas safety controls	Fulton Sylphon Div. Robertshaw-Fulton Controls Co.
Gauge board	Nordberg Mfg. Co.
Alarm panel	Viking Instruments Inc.
Exhaust pyrometers	Alnor, Illinois Testing Labs., Inc.
Gauges	J. E. Lonergan Co.
Vacuum gauge	Meriam Instrument Co.



Operator Paul Jones, in the plant 22 years, checks 1750-hp, 4-cycle, supercharged Nordberg Duafuel. The No. 2 engine behind it is an 880-hp, 257-rpm unit installed in 1934.

ADS Meeting Helps Everyone

Part of attentive audience at a technical session. Association officers (President Wittersheim standing) are in background. Lady is Mae Hute, Woodward Governor, who contributed greatly to smooth operation of the meeting which was a very successful affair.

ASSOCIATION meetings pay off in several ways, attend and you're bound to learn. You get solid information through the formal program and usually pick up just as much through informal contacts. When a group of people with the same interests gather from all over the country, you can't come away from such a pool of know-how without some payoff ideas. You get back home and put these to work. You benefit and if you're in the service field, so do your customers.

Take the recent meeting of the Association of Diesel Specialists in New Orleans, for example. Representatives of shops (members and prospective members) engaged in sales and service of fuel injection equipment, governors and allied equipment, and manufacturers of such equipment got together to discuss topics of mutual interest. Here are some high spots.

ADS's technical program started off with a very comprehensive talk and demonstration of how to disassemble, inspect and repair RoosaMaster fuel injection pumps. Jim Britton of Hartford Machine Screw Company did a good job and answered all questions shot at him.

Action then moved to Gerhardt's, Inc. where this spotless and well-equipped shop was turned over for a how-to-do-it session. Two pump calibration stands were put to work. Henry Ortner of American Bosch ran through testing and calibration of a PSB pump while Jim Britton did the same with a RoosaMaster. Don Carncross of Woodward Governor Co. officiated at the governor test stand and Oscar Merian, Bendix-Scintilla, covered the techniques of nozzle reconditioning.

Switching from the technical side, Gerhardt's attorney gave a good talk on shop labor management. With broad experience in this field, he offered concrete suggestions on handling such problems in the best interests of both labor and management.

Incidently, conduct of the whole meeting showed the tremendous strides made in the organization of this young association. Its By-Laws are all set and fine points of policy are being worked out. An official seal has been designed and you'll be seeing it soon displayed in member shops.

Jim Britton, Hartford Machine Screw, covered disassembly, inspection and repair of RoosaMaster pump.

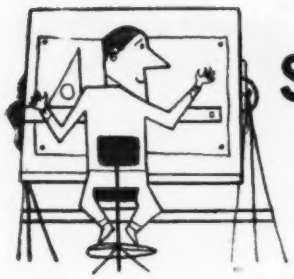
Service to members is being improved. A reference file just started is a concrete example. It included everything from technical bulletins to product brochures of interest to the membership. All members get copies and will receive additional material as available.

Getting back to the meeting, the amount of notetaking was evidence that the program was ringing the bell. Later, frequently-heard comments such as "Give me your card. I'll shoot you all the information on that", was proof of the effectiveness of personal contact.

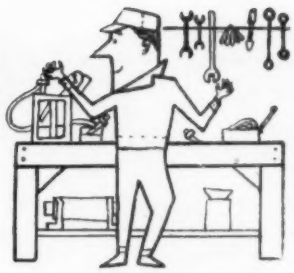
Such meetings have "satelites" too. Prior to the regular program, Henry Ortner conducted an official American Bosch Clinic, sponsored by the American Bosch Central and Service Stations of New Orleans. Their customers and attending ADS members numbered over 300.

Such opportunity for close liaison between factory and field is extremely helpful. Next meeting of the ADS at the Shamrock Hotel, Houston, Texas on 14-17 February, 1958, will extend this idea by scheduling a day for individual and group meetings with the different manufacturers.

So association meetings offer opportunity for closer cooperation between factory and service agency. Both benefit and through the resulting improved service—so does the user.



service section



Recent engine and equipment modifications, procedures and recommendations straight from the different manufacturers to you

Injector Hole Tube Added To GM "71" 4-Valve Cylinder Head

To facilitate manufacturing, the copper injector hole tube used on all standard Series 71 engines has been incorporated in the four-valve cylinder heads used on the turbocharged engines.

When redesigning the four-valve head, considerable thought was given in order to permit use of the same service tools as used for the standard Series 71 engine.

The use of the copper hole tube in the four-valve cylinder head has necessitated relocating the injector-locating dowel hole. If the injector-locating dowel had remained in the same position as used with the cast injector hole, an interference would have been encountered with the tube.

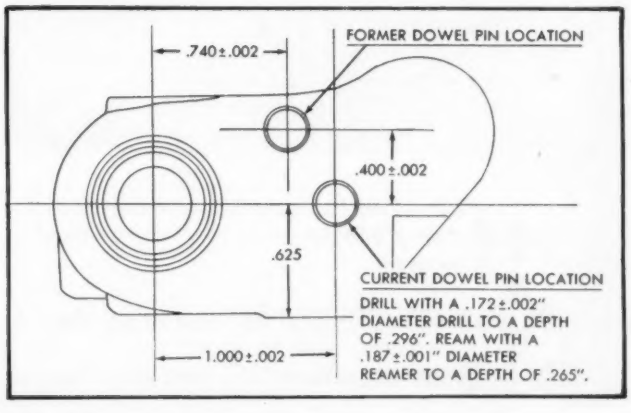
As a result, the injector-locating dowel hole has been moved to the same position, in relation to the center of the injector hole tube, as in the standard engine. The dowel in the current injector assemblies has been relocated in the body of the injector accordingly.

To eliminate the need of an engine owner remembering whether his engine had an old style or new style head, a special service injector assembly has been provided. This has both dowel-holes drilled in the injector body and the injector-locating dowel loose within the package. By inserting this dowel into the proper hole, this injector assembly may be used in both the current and the former cylinder heads.

As a service measure, when a cylinder head having an integral injector hole is replaced with the current cylinder head with the copper hole tube, the original injectors on the unit may be used providing the injector bodies are drilled relocating the injector dowel.

This machine should be performed as outlined in the sketch and the injector-locating dowel inserted in the new hole.

Only the new cylinder head and the new type service injector assemblies will be available from the factory.


.740±.002
FORMER DOWEL PIN LOCATION
.400±.002
.625
CURRENT DOWEL PIN LOCATION
DRILL WITH A .172±.002" DIAMETER DRILL TO A DEPTH OF .296". REAM WITH A .187±.001" DIAMETER REAMER TO A DEPTH OF .265".
1.000±.002

Cause of Slow Shut-Down on Cummins

Some cases of engine missing, or rough running, and slow shut-down with the PT fuel system are due to broken or deformed injector cup gaskets which partially plug the drain orifices. Slow shut-down is caused more often by a plugged drain orifice than by a faulty shut-down valve.

Use the following method to locate injectors with plugged drain orifices:

A. With the engine warmed up and running at idle, check the temperature by feeling each of the injector drain lines to the drain manifold. The one attached to the injector with the broken gasket will be cooler than the others.

B. As a second check, disconnect the cool drain line. If the drain of the injector shows fumes and little fuel, the drain orifice will be partially plugged.

C. As a third check, hold down the suspected faulty injector while shutting down the engine. The engine will stop normally. A broken cup gasket in an injector causes slow shut-down of the engine.

(Continued on Page 77)

news of our industry

More Miles and Power with Diesel Trucks

"Going diesel" has proved profitable for the Byers Transportation Company, Inc., Kansas City, Mo. They have found greater operating efficiency and a marked increase in fuel mileage from their equipped units.

According to Jack Reitzes, assistant to the president, Byers intends eventually to go all out for diesel power. So far it has acquired 21 Cummins JT-6-B engines in its fleet of 183 trucks, trailers and tractors.

Byers has discontinued entirely gasoline-powered over-the-road equipment but is still operating a number of LPG units. Their records show Cummins-powered White 9000's fuel cost per mile is 40% less than for LPG-powered trucks. That isn't hay when multiplied by the 2½ million miles a year traveled by its fleet in inter and intrastate hauling between Kansas City, St. Louis and St. Joseph.

Management likes these fuel savings and Byers drivers "like the power of a diesel". They are able to maintain steadier road speeds with diesel-equipped machines.

One Machine Is Whole Team

This Eimco 105 Front-End Loader proved a jack of all jobs on a rush road repair near Tacoma. Flash floods washed out a too-small culvert and 100 ft of roadbed. To the rescue came this combination unit—excavator-carrier-crane-dozer-loader.

It cleared debris, excavated a new culvert trench, "bucketed" and hauled 48-in. concrete piping, then improvised as a crane to position the pipe in the 150-ft trench. That done, the Eimco went to work as a loader-dozer to rebuild the roadway to its former level.

All these jobs accomplished by a single unit underlines the value of multi-purpose machines. They save time and money. Coast Contractors, Inc., owners of this versatile model, depend largely on many-purpose equipment.

MonCon Demonstrates ALCO Locomotive

Blast furnaces tower over Monongahela Connecting Railroad's new ALCO 1800-hp all-purpose locomotive at Jones & Laughlin Steel Corp. Pittsburgh works.

Executives inspecting the new DL-700, powered by ALCO 12-cyl Model 251 diesel, rode in a special gondola. Included in the demonstration—a real working session on the third shift—was the haul of 1865 trailing tons over a 1.86% grade and a tight curve. The new unit replaces an 1100-hp locomotive which MonCon says became obsolete.

new products . . . . . Page 60

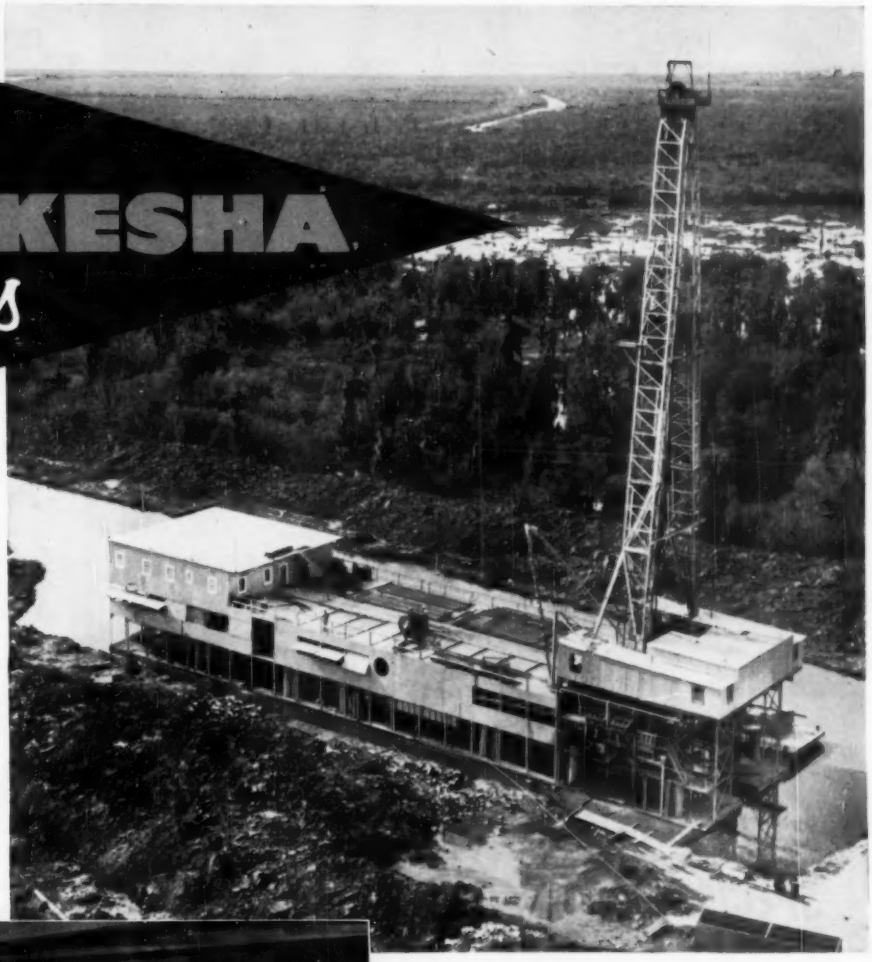
organizational news . . . . Page 64

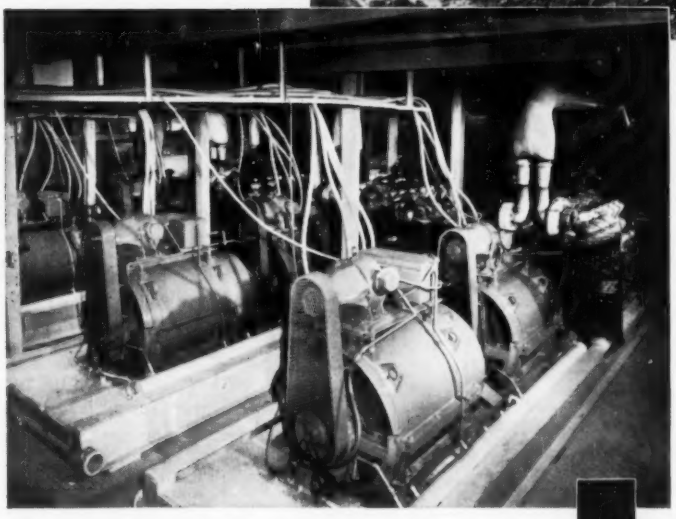
new literature . . . . . Page 68

five WAUKESHA Diesels

on RIG 6 of the CIRCLE DRILLING COMPANY

SUPPLY ALL POWER





• Circle Drilling Company's 143-ft. Rig No. 6—mounted on their 52 x 220 ft. barge *Kirk C. Lewis* which operates in water to 18 ft. in depth—is one of the world's largest Diesel-electric outfits. Shown here at Week's Island, La., it is drilling a 17,000 ft. well for a major oil company.

Three Waukesha V-12 Diesels—each driving two 540 KW, DC generators—supply power for the Ideco E-2500 drawworks, and rotary; and two Emsco D-1000 slush pumps. These three Waukesha V-12 Diesels are Model VLRDBSU—12-cyl., 8½ x 8½-in., 5788 cu. in., counterbalanced crankshaft—have exhaust driven dual turbochargers for extra power.

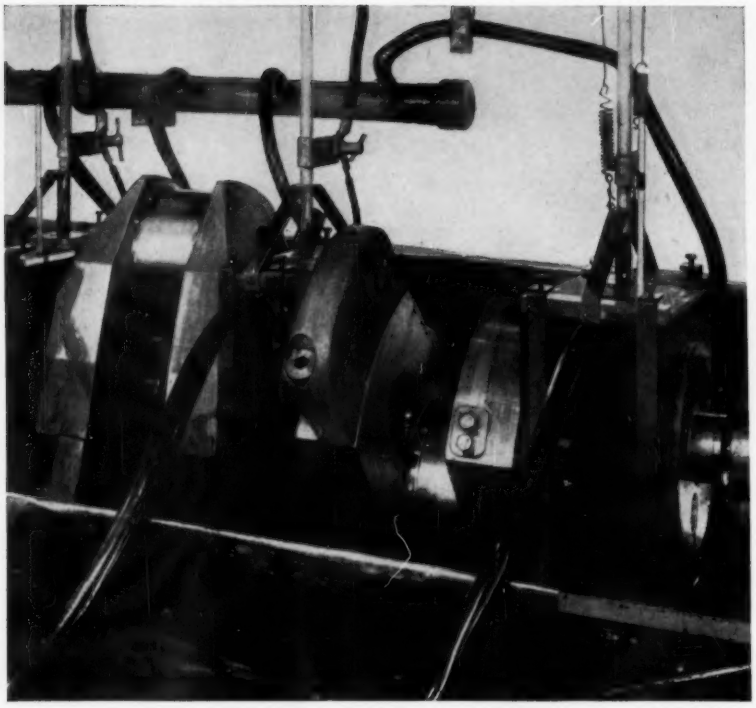
Two additional Waukesha Diesels—driving two 200 KW, AC generators—supply power for rig lighting and other auxiliary needs. The mud-mixing pump is an Emsco D-300. These two Waukesha Diesels are Model NKDBSU, 6-cyl., 7 x 8¼-in., 1905 cu. in., turbo-supercharged engines with counterbalanced crankshafts.

Send for Bulletins 1663 and 1634

WAUKESHA Engines and Power Units: 10 hp to 1235 hp—
Turbocharged and Normal Diesels • Natural Gas • LP Gas
Get Bulletin 1079

WAUKESHA MOTOR COMPANY
WAUKESHA, WISCONSIN
New York • Tulsa • Los Angeles

347-R

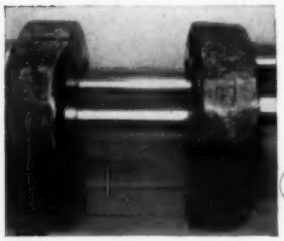


THIS REBUILT CRANKSHAFT IS CHROMIUM PLATED BY A SPECIAL NATIONAL FORGE PROCESS

When your crankshaft is reconditioned at National Forge, here's how it is chrome plated. Each bearing surface is individually boxed and plate thickness is built up only as required. Different thicknesses—over 1/8" if needed—can be added to different surfaces of the same crank. Because only the boxed surfaces are exposed to plating action the fillet areas retain their original strength.

When applied by National Forge specialists, chrome plating is uniform and smooth. Regrinding is kept to a minimum and your reconditioned crankshafts are returned to you meeting the original shaft's specifications.

No other plating company has National Forge's experience in handling both new and rebuilt crankshafts. So why not try National Forge specialists on your crankshaft rebuilding jobs?



This is a finished, repaired crankshaft after processing by National Forge.

For more details on crankshaft repair, write for Bulletin RC-2.

NATIONAL FORGE
AND ORDNANCE COMPANY
IRVINE, WARREN COUNTY, PA.

news of our industry

Big Refrigerator Car Order

Construction of 1000 mechanical refrigerator cars, costing more than $20 million, has been started by Pacific Fruit Express Co., jointly owned by Union Pacific & Southern Pacific Railroads. Most of these units will be powered by diesels.

When all the new cars are in service, the PFE will have about 34,000 in its refrigerator car fleet.

Diesel Study by Mail

Interstate Training Service offers correspondence courses in diesel, tractor, heavy equipment and other fields. Besides being a member of the Diesel Engineers International Association, the school is accredited by the National Home Study Council.

Since the founding of ITS in 1944, some 30,000 students have completed training by mail.

RR Engineering Award Goes to AAR

Association of American Railroads on October 16 received the Franklin Institute Medal for its many achievements in railway engineering. Research efforts of the AAR have resulted in more dependable equipment and tremendous savings in rail operations. Its accomplishments are reflected in greater safety and reduced transportation charges for industry and the public.

Cat Dozer Readies New Cat Plant Site

Appropriately enough, a Cat D8 tractor bulldozed the first bladeful of earth preparatory to construction of a new industrial engine plant near Peoria, Ill. for Caterpillar Tractor Co.

The 500,000-sq ft facility is the first of three scheduled for the 1100-acre tract. It will house manufacturing operations for Model D397 with 650 maximum hp and D375 with 430 maximum hp. A multi-purpose research center and a general offices building are slated for the future.

In all, the construction program will involve some $200 million over the next three years. About 3500 people will be employed in the new area when the whole project is completed.

news of our industry

Diesel Generator Aids Islanders

When a heavy rainstorm knocked out generators of a private company, the Navy sent a 625-kw diesel generator by barge to Block Island, R. I. The 800 natives and 2000 vacationers on this island resort just had to "rough it" overnight until the emergency power unit arrived.

RR Operators Attend GE School

Short-line railroad and industrial operators attended a week-long session on operation and maintenance of General Electric diesel-electric locomotives. Mechanical details, connection diagram symbols, renewal parts and motor and control maintenance were outlined as they apply to standard 25-to 80-ton locomotives. Factory tours and demonstrations supplemented lectures.

U. S. Army Award to Twin Disc

Twin Disc Clutch Company has been cited for its support of the Reserve Program of the Armed Forces.

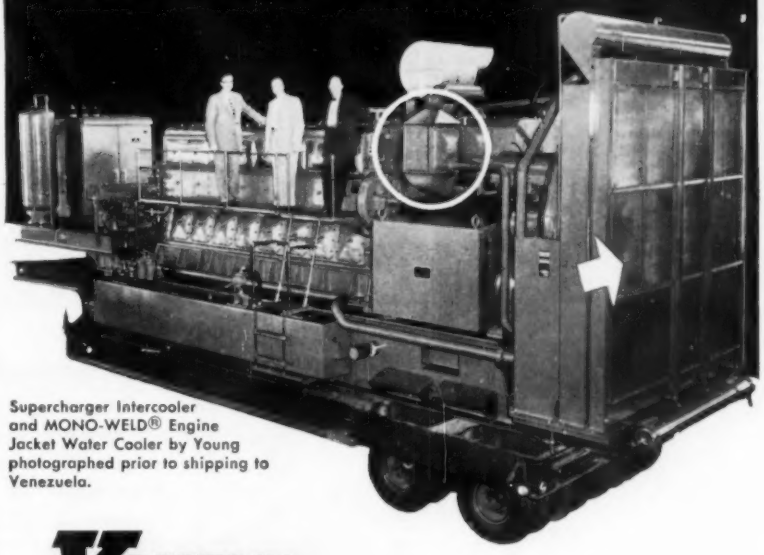
The citation mentioned the outstanding leadership and cooperation of the company. Through its policies of hiring and promoting Reservists without discrimination and granting of leave for training, Twin Disc has encouraged employees to participate in Reserve activities. In addition, the company offers meeting rooms, training aids and transportation to assist Reserve units in performing their duties.

OGP To Meet

Coming up on December 3-4 are the important Oil and Gas Power Sessions at the Annual Meeting of the ASME to be held at the Statler and McAlpin Hotels in New York City. Up for discussion the first day are the subjects of Pressure Fluctuations in Multi-cylinder Exhaust Manifolds and Super-Charge System for Compression, Pilot and Spark-Ignition Engines.

The second day a wide variety of papers will be presented on topics such as lab reports on detergent additives, wear control in piston engines and filter performance tests.

for the largest unit of its kind in the world...



Supercharger Intercooler and MONO-WELD® Engine Jacket Water Cooler by Young photographed prior to shipping to Venezuela.

Young Radiator Company provides the cooling system

MASSIVE TRAILER-MOUNTED MOBILE GENERATING PLANT IS BUILT FOR SOUTH AMERICA . . .

Designed by Young engineers, built by Young Radiator Company, the cooling system for this gigantic unit is now playing its part in a major construction project in Venezuela.

Top quality design and construction of the world's largest trailer-mounted, mobile 1250 kw diesel generating plant—developed and built by the White Diesel Engine Division of the White Motor Company, Springfield, Ohio, demanded a cooling system of equal quality and reliability. Young Radiator Company, with their unmatched years of experience, provided the answer.

A Young Special Model 600 Engine Jacket Water Cooler and Young Supercharger Intercooler cools the White Superior 1765 hp Diesel Engine. The cooling equipment by Young is built to last the lifetime of the power plant which may be used in the future to supply the electric needs of a new Venezuelan town of 10,000 people.

At home and overseas Young quality and experience have made the name "Young" synonymous with the best in design and construction. If you have a heating or cooling problem do not hesitate to consult us. There is no obligation.

Write today to Dept. 417-L for catalogs No. 1652 and 557.

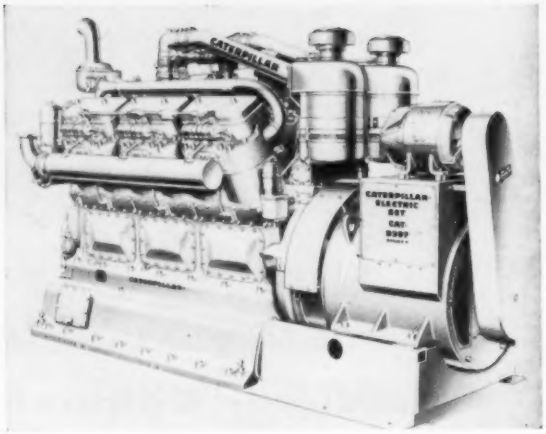
Young RADIATOR COMPANY

RACINE, WISCONSIN

Creative HEAT TRANSFER ENGINEERS

Executive Office: Racine, Wisconsin, Plants at Racine, Wisconsin, Mattoon, Illinois

new products



Spark-Ignition Electric Set For Multi-Fuel Engines

High output and compact design are features of the new Caterpillar D397 spark-ignition electric set. The set's self-regulated, constant-voltage generator produces 250 kw of 60-cycle, 3-phase current at a choice of 240, 480 or 2400 v at 1200 rpm. It is also available to generate 50-cycle current.

A vee-type D397 diesel powers the electric set. It is equipped with simple alterations for fuel carburetion and magneto ignition system for operation on methane, butane, propane or field gases.

Top-mounted exciter and a single, heavy-duty bearing on the new Cat SRCV generator makes the unit compact. A flex-plate coupling to the engine flywheel further eliminates a front bearing and simplifies alignment.

Oil Condition Meter

Gerin Corporation's Wear Meter is an ingenious lube oil viscosity comparator. It compares the used oil in the engine with a sample of the oil when new. The meter's hand shows the percentages of viscosity change, either increase or decrease. Since wear rates increase as lube oil thins out excessively or when it becomes too viscous to reach all lubricated parts effectively, viscosity changes give some indication of expected wear.

The meter is permanently connected to the engine. One compartment in the meter is automatically filled and a fresh sample trapped when the engine's oil is changed. Thereafter, the engine oil circulates through the remainder of the meter. Internal arrangement is such that this oil keeps the captive sample at its temperature, thus canceling any differential temperature effect on viscosity.

Each time the engine is stopped (or a toggle valve operated with the engine running) a viscosity comparison is made and the meter hand is positioned accordingly. The hand stays in place until the engine is restarted (or the toggle valve opened). Reading both increases as well as decreases in viscosity, the meter is adaptable to natural gas and LPG engines as well as diesels.

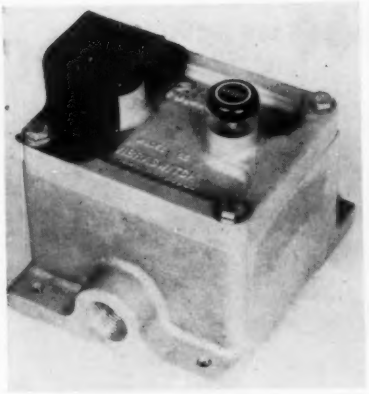
The meter is easy to install, is compact, rugged and well backed by guarantee. It comes ready to install with everything furnished. It will operate on any oil system pressure from 5 to over 100 psig.

Seals for Dipstick and Oil Filler Pipes

Here's a new device for the fight against dirt in diesels. An air-tight seal has been developed by Moeller Manufacturing Company for dipstick openings, shown here, and for oil filler pipes.

Engines with provision for low pressurized crankcases get protection from dirt and impurities with these adjustable closures. A clockwise twist of the handle expands the rubber washer to seal the opening. A reverse turn loosens the seal for removal of dipstick or oil filler plug.

This adjustability, along with rust and corrosion resistance and positive sealing action, makes them ideal for dirtproofing diesels arranged for operation with crankcases under low pressure.



Malfunction Detector

This automatic vibration detector is designed for rotating and reciprocating equipment with more than normal vibration. Made by Robertshaw-Fulton Controls Company, the new low-sensitivity monitoring device has a range of 0 - 4.5 g.

Cased in explosion-proof housing, Model 65-LS is suitable for Class 1, Group D; Class 11, Groups F and G hazardous applications. It is available with either single-pole double-throw switch or split contact normally open switch. Both are rated at 7 amp, 460v ac.

Adjusting sensitivity and resetting are done without opening the housing. A tamper-proof guard protects the control.

Alcoa Paints in Color

Aluminum Company of America has developed a line of colored aluminum paints and aluminum asphalt roof coatings. They will waterproof, insulate and protect tanks and practically any metal surface. Colors offered by several paint manufacturers are copper, gold, blue, green and brown.

Effective Corrosion Inhibitor

Corrosion problems are every day headaches. One cure recommended by Beacon Chemical Industries is Triethylammonium Phosphate 802. It is suggested as an additive in closed systems where water, alcohol, glycerine or glycol are used.

As an additive to coolants, it inhibits rust formation in tractors, road building machines, marine engines, drilling rigs and other equipment.

Here's how Snap-on provides specialized hand tool service across the board for industry

Production... *Snap-on* offers a complete range of wrenches, sockets and specialized tools for product assembly.

Original Equipment... *Snap-on* makes up custom-built tool kits to be included with new products shipped from the factory.

Maintenance... *Snap-on* provides maintenance tools for servicing anything from plant facilities and machines to every type of vehicle.

Field Service... *Snap-on* assembles special field-service tool kits for repairing everything from diesel engines to business machines and appliances.

Plus Snap-on Personal Service

Snap-on Sales Engineers work closely with industry to cut costs, keep production on the move. Here are a few examples:

Now revamping one company's entire tool crib setup (year-long project).

Put *Snap-on* engineer right on electronic assembly line to design special pliers.

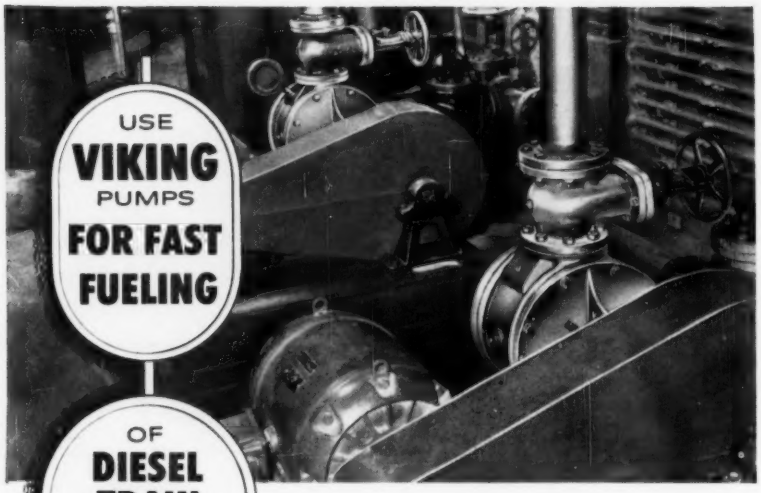
Spent weeks on excavator assembly line to provide special tool kit.

Same as above on diesel engine assembly line.

Continually providing special long-life impact sockets on dozens of assembly lines.

Whatever *your* tool problem, *Snap-on* can render a specialized service. Branch offices and warehouses are located in key industrial centers throughout the U.S. and Canada. Write us or call your nearby *Snap-on* representative.

SNAP-ON TOOLS CORPORATION
8064-K 28th Avenue • Kenosha, Wisconsin



USE
VIKING
PUMPS
FOR FAST
FUELING
OF
DIESEL
TRAIN
ENGINES

To meet close schedules, it is important to have fast, positive fueling of diesel train engines.
Fast fueling is assured when you install positive Viking rotary pumps, like these two 200 GPM Viking Heavy Duty diesel fueling pumps at an eastern railway terminal.

For complete information, ask for Catalog Cd today.

VIKING PUMP COMPANY

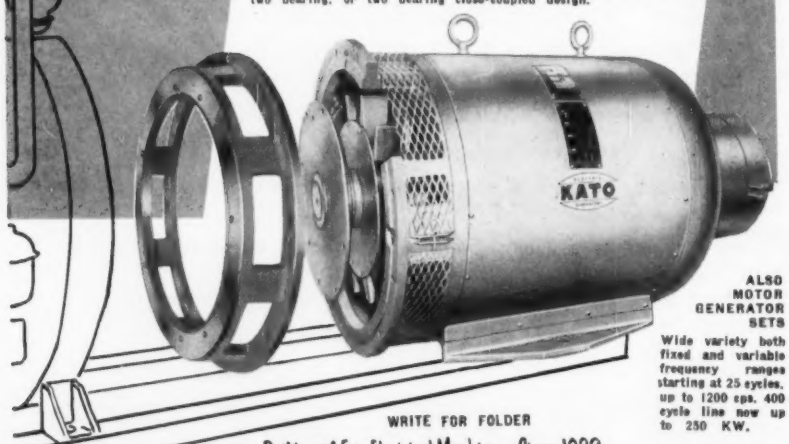
Cedar Falls Iowa U S A In Canada it's "ROTO-KING" pumps
See our catalog in Sweets

KATO GENERATORS
Fit The Engine Of Your Choice!

CHOICE OF FLEXIBLE COUPLINGS

Adaptable to ALL ENGINES with SAE Bell Housings

There is a size in the Kato line of generators with the electrical characteristics to meet your specific requirements. By means of one of Kato's flexible steel, disc-type or bonded rubber couplings, Kato generators easily connect to any diesel or gasoline engine. All standard frequencies . . . 25, 50, 60 and 400 cycles, plus many special frequencies to 1200 cycles (both fixed and variable). Now 400 cycles to 250 KW, 60 cycles to 500 KVA. Extra lead wires brought out insure a maximum voltage selection. Single, standard two bearing, or two bearing close-coupled design.



ALSO MOTOR GENERATOR SETS
Wide variety both fixed and variable frequency ranges starting at 25 cycles, up to 1200 cps. 400 cycle line now up to 250 KW.

WRITE FOR FOLDER

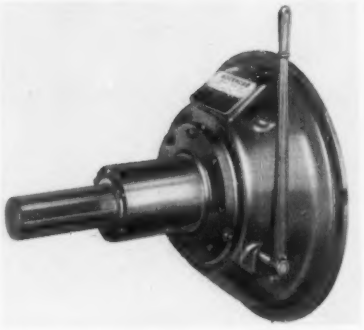
Builders of fine Electrical Machinery Since 1928

SPECIAL ORDERS WELCOMED

KATO *Engineering Company* 1408 First Ave. Mankato, Minnesota

PHONE 8-2941

new products



Rugged Power Take-Off

Several new features are incorporated in the extra heavy-duty power take-off manufactured by Rockford Clutch Division, Borg-Wagner.

The conventional and often troublesome PTO pilot bearing has been eliminated. Outboard bearing supports and flexible couplings are not necessary because of the rugged construction and the arrangement of main bearings. Main shaft bearings require lubrication not more than once a year. Clutch release bearing is lubricated for life. Main bearings are 40,000-hr type. Belt loads up to 5000 lb are handled on the well supported drive shaft.

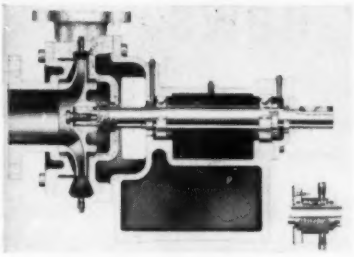
This heavy-duty power take-off is furnished with single or double plate, organic or Morlife cerametalic faced gear-tooth drive type clutches.

Portable Dredge Developed by Ellicott

New portable 8-in. hydraulic dredge, suitable among other uses for road construction fill in swampy sections, has been designed by Ellicott Machine Corp. Part of the Series 130H line of hydraulically operated "Dragon" models, the new unit has a rated output of up to 85 cu yd per hour.

Heart of the dredge is an Ellicott 8-in. heavy-duty centrifugal suction pump powered by a 6-cyl diesel with a continuous rating of 142 shaft hp. This main diesel also operates the hydraulic pump for supplying power to the cutter and winch motors, eliminating the expense and extra weight of auxiliary power supply.

new products



High-Speed Centrifugal Pumps

A new line of high-speed, high-head centrifugal pumps for general water service is reported by Gardner-Denver Company.

These Model BH pumps are made in four sizes. The 1-in. model has capacities to 150 gpm, 1½-in. model with capacities to 220 gpm, 2-in. with capacities to 440 gpm and a 3-in. model has capacities to 520 rpm.

All perform at high efficiency over a wide range of service conditions and offer features of design and material assuring long life, the manufacturer states.

Features mentioned include stainless steel shafts, oil-lubricated heavy-duty ball bearings, mechanical seals, accurately contoured casings and hydraulically balanced bronze impellers.

Inset on BH pump photograph shows double mechanical seal for low head installations.

New Parts Cleaning Machine

Miji-Lif is the new 30-gal cleaning machine which handles up to 75 lb of work at a time. Introduced by Magnus Chemical, this mechanically agitated machine does it all with compressed air.

A flick of the operating lever brings the 21-in. by 18-in. platform to the top of the tank for inspection, loading and unloading. A second flick returns the platform to the bottom of the tank where work is automatically agitated in the solution.

Besides usual cleaning operation, the unit can be used for applying protective coatings to metal parts.

For more details on any of these products, just fill in the postal card inserted in this publication.

High Voltage Motor Generator Sets

A new series of both high-voltage motors and high-voltage generators has been developed by Kato Engineering Company. Motors are available as large as 200-hp, 4160 v at 1200 rpm. Generators are available as large as 300 kw, 4160 v at 1200 rpm.

The machines, on a common welded steel base are connected by a flexible coupling. Dowel pins and pin holes are placed at four corners of both alternator and motor base mountings to assure accurate alignment.

Good News for Winter Driving

This winter you can spray away the problem of windshield icing. E. I. duPont has developed a de-icer handily put up in an aerosol package.

Lab tests show the compound sprayed on beforehand will prevent ice from forming. If used after ice has formed, it will melt a 1/16-in. coating in three minutes flat, duPont promises. Tests also indicate the new formula has no adverse effects on auto finishes or metal trim.

DuPont has made the de-icing compound available for marketing by aerosol packagers.

FUEL INJECTION EQUIPMENT DIVISION
of
LUCAS ELECTRICAL SERVICES, INC.
Head Office: 653 Tenth Avenue, New York 36, New York
Sales Office: 14820 Detroit Avenue, Cleveland 7, Ohio
West Coast: 5025-29 W. Jefferson Blvd., Los Angeles 16, California
Canadian Distributors:
Joseph Lucas (Canada) Ltd., Head Office: 11 Davies Avenue, Toronto 8, Ontario
Branch Office: 3401 St. Antoine Street, Montreal 30, Que.

API74-820

organizational news

Miehle-Dexter Director

Hans Bohuslave, general manager of Miehle-Dexter Supercharger Division of Miehle-Goss-Dexter, Inc., announces the appointment of Dr. Klaus C. Karde to a newly established position of director of engineering, research and development. Prior to this, Dr. Karde was manager of research for P & H Diesel Engine Division of Harnischfeger Corporation.

Dr. Klaus Karde

Paul O. Lewis

Cleveland Diesel Transfer

Paul O. Lewis has been transferred from the engineering department to head sales engineering at Cleveland Diesel Engine Division, GM.

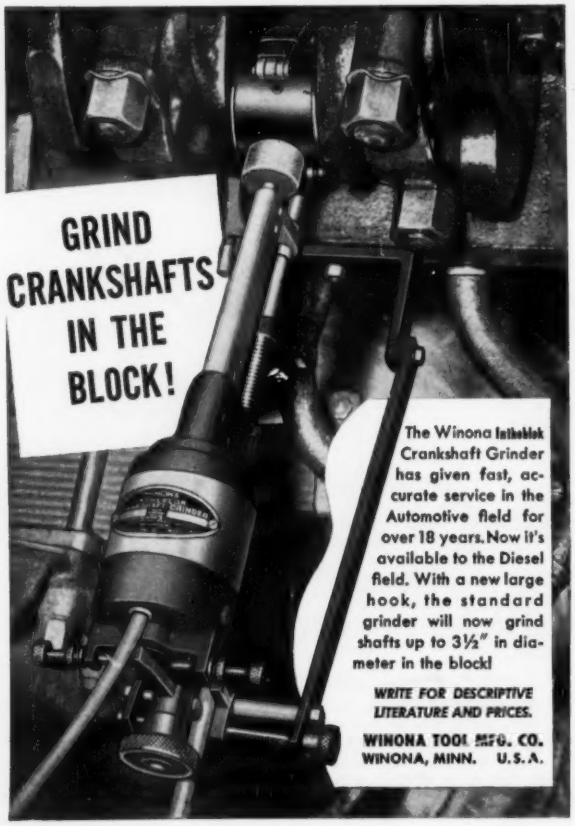
Mr. Lewis has been with Cleveland Diesel for 20 years. He is a member of the American Society of Naval Engineers and the Society of Naval Architects and Marine Engineers.

Burmeister & Wain Designer

Poul A. Christensen, president, reports the appointment of William Kirk as designer for Lathrop Engine Division, Burmeister & Wain American Corporation.

Formerly he was research engineer for Worthington Corporation, chiefly concerned with turbocharging and air flow studies of diesel and natural gas engines. During World War II he served with the Diesel Repair Group at the New London Submarine Base.

William Kirk


GRIND CRANKSHAFTS IN THE BLOCK!
The Winona Lathelok Crankshaft Grinder has given fast, accurate service in the Automotive field for over 18 years. Now it's available to the Diesel field. With a new large hook, the standard grinder will now grind shafts up to 3½" in diameter in the block!
WRITE FOR DESCRIPTIVE LITERATURE AND PRICES.
WINONA TOOL MFG. CO.
WINONA, MINN. U.S.A.

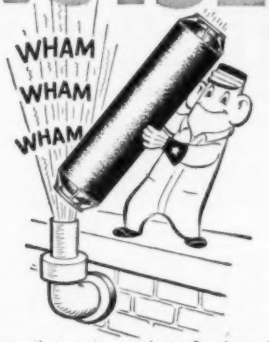
KIM
Hotstart
electric pre-heater
for Diesel Engines
KIM HOTSTART pre-heaters circulate hot water through engines when they are not in use; protect them against bitter winter weather; keeps engines responsive to the touch of the starter. Lightweight; low cost; high in savings. Thousands in use.
★ Quick easy starts
★ Saves warm-up time
★ Reduces engine wear
★ Cuts maintenance costs
★ Easy to install
Write for literature.
KIM HOTSTART MANUFACTURING COMPANY
West 917 Broadway, Spokane 1, Washington

STOP THAT NOISE!

from Air, Steam and other gas discharges

with

BURGESS-MANNING SNUBBERS



Stop that noise and profit through better neighbor and employee relations. Avoid compensation claims.

Burgess-Manning Snubbers are engineered to effectively correct your specific noise problem.

From a WHAM

BURGESS-MANNING COMPANY

Sound Engineering 751 EAST PARK AVENUE, LIBERTYVILLE, ILL. DALLAS, TEXAS

KIENE®

MODEL K-120

universal peak firing and compression pressure indicator

The Model K-120 is the only maximum pressure indicator that can be used as a compression tester on small, high-speed engines and as a firing pressure indicator on engines having indicator valves. Patented Kiene diaphragm type check valve of stainless steel has no springs or piston, no complicated adjustments, temperature corrections or pressure loss. Bleeder valve permits release of indicator pressure for repeat readings. This instrument gives true pressure readings with an uncompensated gage.

Adaptors for most models U.S.A. engines. Others made to order at reasonable prices.

KIENE DIESEL ACCESSORIES, INC.

10352 PACIFIC AVE., FRANKLIN PARK, ILLINOIS

organizational news

Heads Zollner Engineering

Gene Cormany has been appoined executive engineer of Zollner Corporation. He is in full charge of the engineering staff, including design and development of Zollner pistons. He also heads engineering, testing and research of products with engine manufacturers. He will work in close cooperation with Robert B. Hawkins, general sales manager, to provide users with a complete piston service.

Mr. Cormany for the past 17 years has been working with internal combustion engines, including high-output development, and has been closely associated with pistons and related parts.

Gene Cormany

V. V. Boll

C. Wilhite

Two Cummins Transfers

C. E. Martin, general service manager for Cummins Engine Company, Inc., announces two promotions.

V. V. Boll has been upped to manager, warranty administration. With Cummins since 1952, he will now be responsible for product performance section, guaranteed maintenance and warranty administration programs.

C. J. Wilhite is now manager of field service. He joined Cummins in 1939. His new duties include coordination of activities area service managers, export and manufacturer service managers.

Heads Sales For Engine Life

William V. Bernsen is the new sales manager of Engine Life Products Corporation. The announcement was made jointly by W. R. Fuller, president and John Reinshagen, general manager.

His extensive background in the lubrication field includes 14 years with Standard Oil of Indiana and post of industrial sales manager of Luber-Finer Corporation.

A member of the American Society of Lubrication Engineers, Mr. Bernsen helped organize a filtration symposium and courses in lubrication now a part of UCLA's engineering curriculum.

William Bernsen

organizational news

At Aeroquip

John C. Abbey has taken over as chief engineer at the new engineering center of Aeroquip Corporation. Previously, he was product engineer for the company.

DeLaval Separator Realigns Industrial Sales

Wencel A. Neumann, executive vice president of DeLaval Separator Company, has assumed responsibilities for sales and sales policies of the Industrial Division. He continues with his duties in the Manufacturing Engineering and Industrial Relations Divisions.

Also named to new posts were G. Frederick Wheelwright, assistant to the executive vice president; Frank E. Lawatsch, manager of industrial equipment application, and William C. Porch, manager of industrial sales for the Eastern District.

Fourth Plant Opened By Stratoflex

Stratoflex, Inc., maker of flexible hose and fittings, has opened a branch plant at Fort Wayne, Ind. J. C. Nolan has been selected as plant manager. The new facility has 15,000 sq ft of floor space and will expedite deliveries to the east coast and the middle west.

Allis-Chalmers Lab Under Way

Allis-Chalmers Manufacturing Co. broke ground recently for a new $3,250,000 engineering and research laboratory at its Harvey, Ill. Works. This expansion will provide a central engineering building, an engine and material handling product development laboratory and an engine test wing accommodating 32 engine dynamometers.

According to Owen J. Higgins, general manager of the Harvey Works. it will also house an experimental machine shop, a metallurgical lab and a proving ground for material handling equipment. The 65 acres now owned by A-C at this site will allow for future expansion.

Mack Will Build on West Coast

Mack Trucks, Inc. will build its first West Coast manufacturing plant. It will be constructed on a 50-acre site in Fremont, Calif. as soon as building plans are completed.

Represents AAF

C. W. Dean & Associates, Memphis, now handle American Air Filter Company's line of filters, engine and compressor products. These are in addition to AAF dust control and Herman Nelson heating and ventilating equipment which Dean has represented for years in the Memphis area.

A-C International Formed

Formation of Allis-Chalmers International as a major operating division is announced by R. S. Stevenson, president of the Milwaukee company.

P. F. Bauer has taken over as managing director of the new division. Paul Dietz and Floyd J. Mischke have been named associate sales directors of A.C. International.

FREE to Every Shop Operator

- Diesel Compression Testers
- Nozzle Testers for American Bosch, Caterpillar and Bendix Nozzles
- Cummins Injector Tester
- International Harvester Injection Testers
- General Motors Injector Testers
- Injection Pump Calibrating Stands
- Nozzle-Injector Cleaning Tools and Lapping Blocks
- Engine Overhaul Stands
- Engine Removal and Parts Dollies
- GM 71 Engine Tools

SEND COUPON NOW

BACHARACH INDUSTRIAL INSTR. CO. • 200 N. BRADDOCK AVE., PGH. 8, PA.

Send us FREE copy of your Diesel Shop Manual AD54

We are: ☐ Fleet Operators ☐ Injection Service Shop ☐ Diesel Manufacturers ☐ Parts and Engine Distributors

NAME_____

COMPANY_____

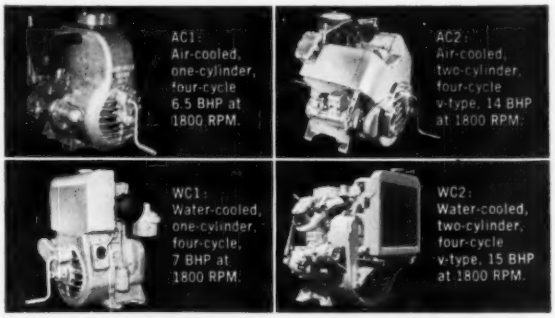
STREET_____

CITY and STATE_____

AD-15

THE BIG 4 IN DIESEL POWER

AMERICAN MARC Inc. dominates the field of lightweight, low-horsepower Diesels by building its diversified line from the "Big Four" basic models illustrated here. Purchase and maintenance of engines and parts are simplified by the use of these compact and rugged prime movers.



AC1: Air-cooled, one-cylinder, four-cycle 6.5 BHP at 1800 RPM.

AC2: Air-cooled, two-cylinder, four-cycle v-type, 14 BHP at 1800 RPM.

WC1: Water-cooled, one-cylinder, four-cycle, 7 BHP at 1800 RPM.

WC2: Water-cooled, two-cylinder, four-cycle v-type, 15 BHP at 1800 RPM.

AMERICAN MARC also manufactures Diesel generating plants from 3 to 10 KW (AC or DC, and industrial three-phase), Diesel pumping units from 48 to 1700 GPM, marine propulsion, refrigeration units and power-packages for other services. American MARC can adapt any of its Big 4 engines to fit every job requiring from 5 to 20 BHP.

INQUIRIES ARE INVITED FROM DISTRIBUTORS AND DEALERS.

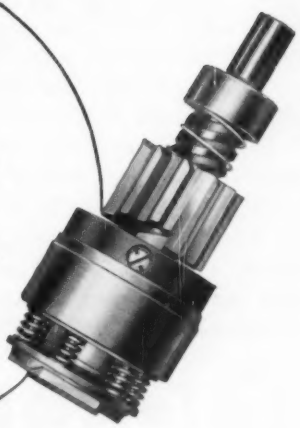
AMERICAN MARC INC.
DIESEL ENGINES
1601 West Florence Ave.
Telephone OR 8-7174
Dept. P-117
Inglewood, Calif.
AMERICA'S LARGEST MANUFACTURER OF AIR-COOLED DIESELS

Here's Why

PERFORMANCE IS BETTER WITH Bendix STARTER DRIVES

CHECK and COMPARE THESE FEATURES

- Starting motor can be mounted more easily and in more positions.
- Requires no actuating linkage—solenoid can be placed in any convenient position.
- Simple in design—has fewer parts—needs fewer adjustments.



It takes a truly outstanding product to receive over 100,000,000 endorsements. Yet, that's the number of Bendix Drives that have been installed. No other starter drive approaches this record of outstanding performance. That is why, whatever your type of diesel or whatever its purpose, it will pay you to specify Bendix* Starter Drive for the most economical installation and dependable performance. *REG. U.S. PAT. OFF.

ECLIPSE MACHINE DIVISION of Bendix AVIATION CORPORATION
ELMIRA, NEW YORK

Export Sales: Bendix International Division, 205 E. 42nd St., New York 17, N.Y.

organizational news

Acquires Florida Diesel

Theodore A. Bates is the new owner and president of Florida Diesel & Electric Co., Miami, Florida.

Before acquiring this firm, Mr. Bates served with American Bosch for almost fifteen years. He has wide experience in the diesel and electrical service and sales fields.

Florida Diesel specializes in servicing American-Bosch, Bendix-Scintilla, Roosa-Master, IH, Cat and GM fuel injection pumps. The company also provides complete governor service.

Joins Con Diesel

Sheldon Matzkin has joined Consolidated Diesel Corp. as contract administrator. He comes to Con Diesel from the Leowy-Hydropress Division of Baldwin-Lima-Hamilton Corp. where he was chief mechanical engineer of the industrial projects department.

New Chief at Snow-Nabstedt

Tracy S. Nabstedt has taken over the helm of Snow-Nabstedt Gear Corporation. He succeeds his father, Arthur T. Nabstedt, Sr. who continues as board chairman.

Cooper-Bessemer Promotion

Grant C. Woodard, general sales manager of The Cooper-Bessemer Corporation makes known the promotion of Earl P. Martin to assistant branch manager of the Houston office. Mr. Martin will work with R. H. Dale, branch manager.

News from Socony Mobil

Leonard S. Marshman is now manager of the Crude Oil Division of the distribution department of Mobile Overseas Oil Company. His start with Socony was as office boy in the Boston district back in 1933.

Another appointment announced is that of LeRoy B. Fox. He has been named manager of the asphalt department, Socony Mobil Oil Co. He succeeds George R. Christie who retired after 41 years of service.

Heads Nordberg Branch

Richard C. Gamble is appointed district manager of the St. Louis territory of Nordberg Manufacturing Co. He succeeds R. P. McBride who returns to the main offices in Milwaukee.

Manages Aeroquip RR Sales

Appointment of Richard B. Hitt as manager, railroad sales, is announced by William F. Rogge, general sales manager, Industrial Division, Aeroquip Corporation. Mr. Hitt started with Aeroquip in 1951 as customer service correspondent.

Two Promoted by Long

A. H. Schmal has stepped up to the post of general sales manager, Long Manufacturing Division, Borg-Warner. A member of SAE, Mr. Schmal has been associated with Borg-Warner divisions since 1953.

Another Long promotion is that of Roy Norton to director of engineering. He, too, is a member of the SAE and has been with this firm for three years.

new literature

For Slime Control

For control of algae and slime in water tower fill, United Chemical Corporation recommends El-Tox. This metallo-organic slimicide is described in a new technical bulletin just released. The maker states it is effective in dosages as low as 200 parts per billion and it produces positive results in a matter of hours.

All About Blast Cleaning

A new brochure by Wheelabrator Corporation tells how they've solved difficult cleaning and finishing problems.

The 34-page book shows by photographs and schematic drawings how airless, air and wet blast cleaning has been employed in specific applications. Short case histories relate experiences of 50 companies.

ROCKFORD

NEW

LONG LIFE

Heavy-Duty

POWER TAKE-OFF

Designed to meet the needs of Oil Field and other rugged service—this ROCKFORD Extra Heavy-Duty POWER TAKE-OFF

- Eliminates the Pilot Bearing
- Release and Main Bearings are lubricated for one year
- Main Bearings are 40,000 hour type
- Handles 5,000 pound Belt Loads
- Out-Board Bearings and Flexible Couplings eliminated
- Furnished with Single or Double Plate, Organic or Morlife® faced Gear tooth Type Clutches

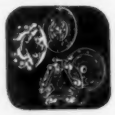
Insure longer work life and reduce down-time with this NEW extra heavy-duty ROCKFORD POWER TAKE-OFF.

BW SEND FOR THIS HANDY BULLETIN
Gives dimensions, capacity tables and complete specifications. Suggests typical applications.

ROCKFORD Clutch Division BORG-WARNER

1301 Eighteenth Ave., Rockford, Ill., U.S.A.

Export Sales Borg-Warner International — 36 So. Wabash, Chicago 3, Ill.


Small Spring Loaded

Heavy Duty Spring Loaded

Oil or Dry Multiple Disc

Heavy Duty Over Center

Power Take-Offs

Speed Reducers

CLUTCHES

All About Solenoid Valves

Approximately 1400 standard items are presented in the new ASCO Solenoid Valve Catalog published by Automatic Switch Co. The 114 pages in eight indexed sections carry a complete run-down on 2, 3 and 4-way type solenoid valves, manual reset 2 and 3-way valves, corrosion resistant and special purpose valves and accessories.

Included are a selection guide, construction details, flow diagrams, cross-section views and a glossary of terms. You can requisition your copy of this catalog on the reply card inserted at the end of this issue of DIESEL POWER.

Hard Surfacing Maintenance

Now available from Eutectic Welding Corp. is a technical publication on overlays. Titled "Hard Surface Maintenance — Industry's Economy Weapon", it treats wear and need for overlays for abrasion, corrosion, friction, heat and impact applications.

Photomicrographs show advantages of shallow penetration, minimized dilution and smallest possible heat affected zone. A check list helps the welder determine which of 15 characteristics his overlay deposit should exhibit.

Case histories cover railroad, earth moving equipment and other wear-preventive uses.

Fuel Cost Comparator

Here is a useful gadget to have at hand—a slide chart for comparing fuel costs of diesel and gasoline engines. This cost calculator, prepared by Cummins Engine Company, Inc., gives at a glance the savings made possible through the use of diesel power.

One side of the chart shows savings on a mileage basis. This is helpful for truckers, bus operators and others whose costs are based on miles operated.

The other side gives the data on an hourly basis for off-highway, industrial, marine, agricultural and other applications where costs are established on an hourly basis.

Ask for your Cummins cost comparator on the reply card in the last section of this magazine.

new literature

Of Interest To Fork Truck Users

Lift truck owners and operators will want to read the new catalog by Hyster Company. In describing its four models, these questions are answered: "What will the truck do?" "Will it stand up in tough service?" "Is it easy to service?"

Finding the right answers to these questions helps owners select proper equipment for handling specific jobs.

The "Why" of Wear Patterns Of Crawler-Tractors

A 6-page piece by The Sight Feed Generator Company explains the "why" of wear and tear on tractor parts. Different stages and conditions of wear patterns are illustrated.

Parts are pictured which can be rebuilt automatically with this firm's Rexarc way-rollers, flanges, idlers, rails, grouser bars and pads. Where manual welding is required on such parts as sprockets and carrier rolls, the manufacturer offers Rexarc hardfacing and manganese electrodes.

The maker claims that Rexarc corrects the wear pattern, restores original efficiency and increases wear resistance.

Geared Flexible Couplings

A new book describing Link-Belt Company's line of improved geared flexible couplings has just been released. It details application and selection data for couplings with maximum bores ranging up to seven inches and ratings from 2½ to 572 hp per 100 rpm.

Four basic applications are covered, each available in ten standard sizes. They are: SE, for direct-driven industrial equipment; SGE, for connecting shafts separated by short distances; SGM for connecting tapered shafts, and SGS, for shafts which are far apart.

Design of these couplings provides for reasonable parallel and angular misalignment with minimum backlash. Wide faced internal gear teeth allow end float of connecting shafts while maintaining full tooth contact.

Major Gas Pipelines Map

The Federal Power Commission has just revised its map of major natural gas pipelines.

Measuring about 13 in. by 18 in., the map is printed in five colors. Besides major existing pipelines, it also shows those under construction, those authorized and proposed lines pending Commission action.

Each pipeline is keyed to an index of operating companies listed. Existing or proposed pipelines systems of 126 companies are represented. In addition to pipelines, the map shows the location of natural gas fields, indicating both major sources and generalized areas of supply.

If you'd like a copy of this pipeline map No. FPC-M-50, just send 25 cents direct to the Federal Power Commission, Washington 25, D. C.

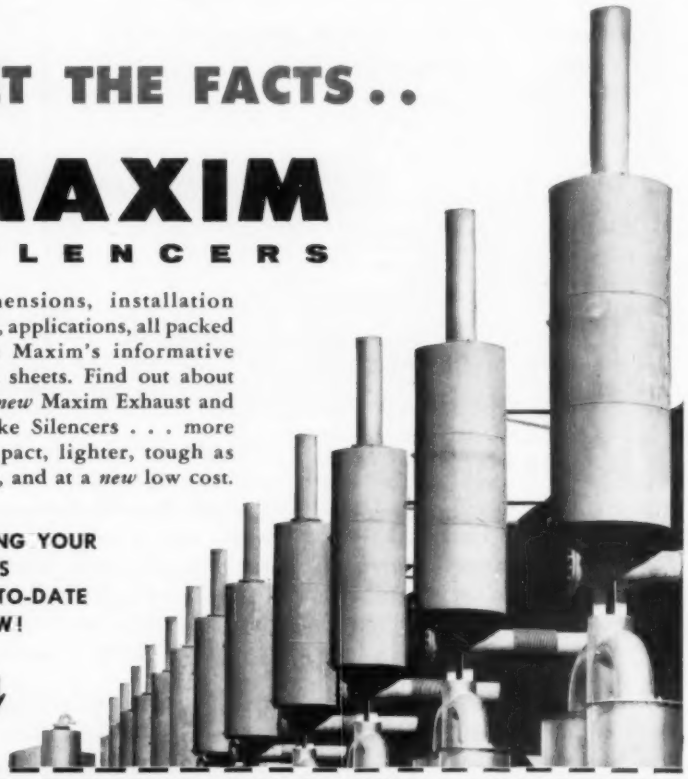
GET THE FACTS..

MAXIM

SILENCERS

Dimensions, installation data, applications, all packed into Maxim's informative data sheets. Find out about the *new* Maxim Exhaust and Intake Silencers . . . more compact, lighter, tough as ever, and at a *new* low cost.

BRING YOUR FILES UP-TO-DATE NOW!



THE MAXIM SILENCER COMPANY

Subsidiary of Emhart Manufacturing Company

93 Homestead Ave., Hartford, Conn.

Gentlemen: Please send bulletins on silencers for:

☐ WASTE HEAT RECOVERY

☐ INTERNAL COMBUSTION AND STEAM ENGINE EXHAUST AND INTAKE

☐ AIR COMPRESSOR INTAKES AND DISCHARGES

☐ VACUUM PUMP DISCHARGES

☐ BLOWER INTAKES AND DISCHARGES

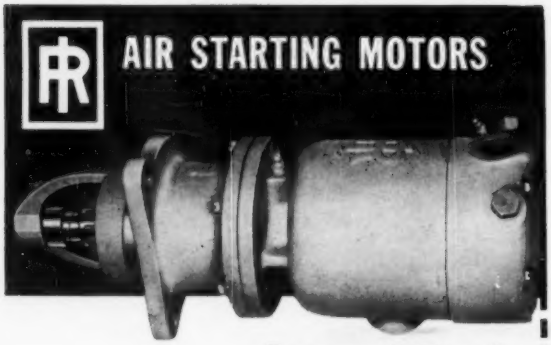
☐ STEAM, AIR OR GAS DISCHARGES

☐ JET AIRPLANE ENGINE EXHAUST AND INTAKE

NAME _____

COMPANY _____

ADDRESS _____



Ingersoll-Rand

5BM for smaller engines

eliminate weight and costs of starting batteries and generators

Dependability: fast, positive starts regardless of temperature. Proven performance. Made by the originators of Air Starting Motors.

Low Cost: compact I-R Air Starting Motors are small, powerful, easily installed. Low maintenance costs throughout long, trouble-free life.

Three Sizes: 5BM, 9BM and 20BM Air Starting Motors meet requirements of complete range of heavy-duty internal combustion engines.

Write for Bulletin 5094D

18-549

Ingersoll-Rand
11 Broadway, New York 4, N.Y.

Quick starts down to

65 DEGREES BELOW ZERO

for Diesel and gasoline engines

SPRAY STARTING FLUID, with the propellent used in the pressurized can, insures quick starts for Diesel and gasoline engines in temperatures as low as 65° F. below zero and withstands 180° F. heat. This combustible propellent was developed after two years of research. SPRAY STARTING FLUID pressurized with our inert propellent is absolutely safe and odorless in storage.

SPRAY STARTING FLUID is sold through distributors, wholesalers and their dealers located throughout the United States and Canada.

SPRAY PRODUCTS CORPORATION

P. O. BOX 584 • CAMDEN 1, NEW JERSEY

new literature

Packaged Power Systems For Mobile Communications

How 2 hp can do the job of 160 hp in keeping truck radio batteries charged is told in D. Onan & Sons new Mobile Installations folder.

It tells how electric plants relieve drain on vehicle batteries and savings which accrue in gasoline and truck engine maintenance. An easy-to-follow chart gives uses and advantages.

Mobile and Fixed Platforms For Waters Up to 600 Feet

A 16-page illustrated book by R. G. LeTourneau, Inc., describes basic requirements for proposed offshore platform which will operate in water depths up to 600 ft—or six times deeper than presently possible.

The text was originally presented in a paper by R. L. LeTourneau before the ASME Petroleum Division at Tulsa.

Users Report on Paper Wipers

Twelve reports have been prepared by Scott Paper Company describing actual uses of industrial paper wipers in specific plants. Benefits of improved safety, better housekeeping, reduced damage to parts and savings in time and money are cited.

Unique Porous Steel Filter

Porous sintered stainless steel filters are detailed in a new Cuno Engineering Corporation catalog. Its 12 pages give characteristics, application data and specifications for the complete line of this unusual filter medium. A selector chart with instructions, plus filtration data tables are added features which help in filter selection.

Designed for high temperature (1000°F for standard material), differential pressures and filtering corrosive fluids, Poro-Klean filters are pre-formed and fabricated in many sizes and configurations.

Ask for Cuno catalog 54-101 on the post card inserted in this issue.

Operation and Maintenance Of Electrical Equipment

Delco-Remy has released a supplement to the 13th edition of DR-324 Operation and Maintenance Handbook.

The bound bulletins cover the care, servicing and testing procedures of such new electrical units as the dry charge battery, enclosed shift lever cranking motors, new double contact regulator and alternating current generators, regulators and rectifiers.

The supplement DR-324A can be purchased at $1.00 a copy. Copies of the Operation and Maintenance Handbook itself may still be obtained at $1.50 each.

Also available is a listing of the many training aids prepared by Delco-Remy. They include charts, manuals, slide films, film booklets and demonstration kit.

For your copy of any of this data, use the postage-free card in the last section of this publication.

new literature

Trouble-Shooter For Hydraulic Systems

Hydrauliscope is an electronic analyzer using oscilloscopic principles to measure pressure, check efficiency and detect shock or surges in the circuit of hydraulic systems.

The maker, Aeroquip Corporation, offers an engineering bulletin on this device now used in many research centers and testing laboratories. Camera attachments are available to record hydraulic activity.

Good Guide for Tractor Care

As an aid to tractor operators, Caterpillar has prepared a Maintenance Guide for its D7, D8 and D9 units. With 75 color pictures and narrative text, the effective comic book format gives helpful hints on getting maximum service from Cat-built equipment.

Methods of preventing abnormal track wear are discussed in detail. Instructions for maintenance of seals, proper track adjustment and lubrication are illustrated. Specific directions show operators how to keep steering clutches, hydraulic boosters, control levers and brake components in best working order. Emphasis is placed on the correct adjustment of oil-type flywheel clutches and control lever operation.

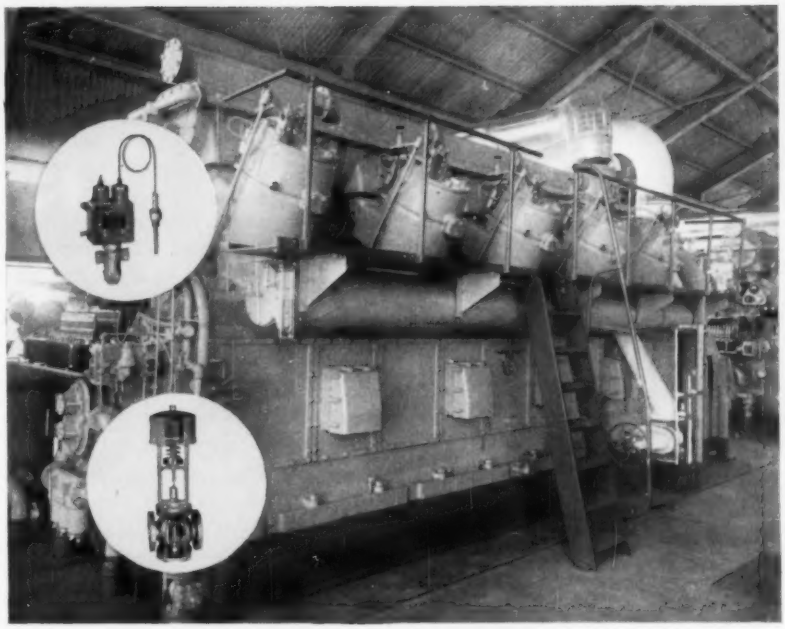
The Maintenance Guide discusses the importance of additive oils, use of the service meter, and filter elements; proper methods for lubricating track rollers and idlers.

Techniques are illustrated for cleaning radiator cores, flushing cooling systems, using anti-freeze and keeping fan belts in proper adjustment. Precautions necessary during cold weather are listed.

Detailed drawings show the best methods of servicing pre-cleaners and air cleaners, and tips are given for periodic inspection of turbochargers.

These are just a few of the many points covered in this Cat maintenance manual. For your copy of this easy-to-follow guide, fill out the reply card inserted in this magazine.

This safety control combination provides maximum SHUT-OFF PROTECTION



Photograph courtesy Cooper-Bessemer Corporation

PROBLEM: To provide the maximum possible shut-off protection against any eventuality for heavy-duty compressors such as this 1350 h.p. unit.

FULTON SYLPHON SOLUTION: With its wide experience in controls for engines and compressors Fulton Sylphon recommended a combination of No. 530 Safety Control and No. 953-E Pressure Operated Valve—both typical soundly engineered products.

RESULT: The No. 530 Safety Control protects the engine three ways —against high jacket water temperature or low lube oil pressure and overspeed. In either case the No. 530 operates the No. 953-E to give bubble-tight shut-off of gas supply and vent the engine's fuel system —voiding any possibility of later damage from accidental ignition. Even in case of accidental injury to the thermal element, the control will trip to shutdown position.

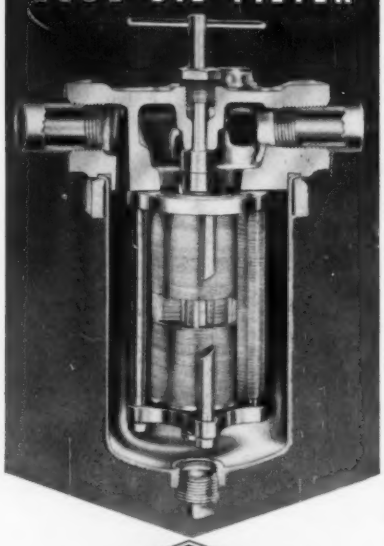
This combination of Fulton Sylphon Safety Controls is relied upon by leading producers of compressors and stationary engines. Investigate them for your engines—send for BULLETIN 817-VD

Mr. Controls

Robertshaw-Fulton CONTROLS COMPANY

FULTON SYLPHON DIVISION • Knoxville 1, Tenn.

Every feature
you want in a
LUBE OIL FILTER



CUNO

AUTO-KLEAN

ALL-METAL EDGE TYPE FILTER

- **HIGHER FLOW RATES IN SMALLER SPACE** . . . up to 300 gpm from a single unit only 40" in height.
- **FINER FILTRATION** . . . single or two-stage types with spacings to 40 microns and positive removal of contaminants.
- **POSITIVE SELF-CLEANING ACTION** . . . no interruption of oil flow.
- **PERMANENT ALL METAL CARTRIDGE** . . . eliminates replacement costs.
- **LOW PRESSURE DROP** . . . less than 5 psi.

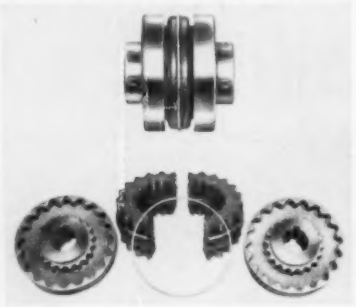
FILTERS FOR DIESEL FUEL, LUBE OIL, AND COMPRESSED AIR. COMPLETE ENGINEERED FILTRATION SERVICE.

CUNO ENGINEERING CORP.
9011 South Vine St., Meriden, Conn.
Filtration Engineers in Principal Cities

CUNO

new products

(*Continued from page 63*)



Soft-Sleeved Coupling Reduces Wear and Vibration

The new Sure-Flex coupling by T. B. Wood's Sons Co. has just three basic parts. There are two hub flanges and a 2-piece rubber sleeve. Internal and external teeth of the sleeve mate with flange hub teeth and lock tight under torque load without clamps or screws. Shock vibrations are absorbed by the coupling sleeve. High torsional flexibility, 15 deg at peak torque, provides smooth power transmission.

Two planes of engagement absorb both angular and parallel misalignment. There's no need for lubrication, Wood states, since there are no wearing or rubbing surfaces.

Easily installed, Sure-Flex couplings are currently supplied in six sizes for motors from 3 to 80 hp. Shaft bores are available from 5/8 to 2 1/4 in.

Nuts Treated With Sealant

Jacobson Nut Manufacturing Corp. is making a new type of locknut with a liquid lockwasher. They are treated with Loctite sealant which provides a high locking torque.

These Jacobson Loctite locknuts come in steel, aluminum and stainless steel, in a wide range of commercial sizes.

USE BELL
INJECTOR CUPS and TIPS
STANDARD AND 21° FOR THE LEADING TRUCK DIESELS
Years of proven service
Volume production on automatic machines means SAVINGS
We pass this on to the consumer
Sold by all parts houses
BELL DIESEL RESEARCH
Pioneers in research and manufacture of high speed diesel injection equipment.
P. O. Box 842, Glendale 5, Calif.
Telephone: Citrus 1-4721

Cleaning-Action Diesel Fuel

Standard Oil of Calif. has introduced its new "Detergent-Action" diesel fuel. Virtues cited by the company—the specially treated fuel retards rusting, prevents formation of gums, reduces fuel consumption, cuts smoke and increases long-term engine power.

Four million miles of company road tests showed clean injector conditions far beyond normal service and reduced piston ring groove deposits.

Other field tests were made under varied conditions. For instance, Consumers Oil Co. of Los Angeles used detergent-action diesel fuel in its tank truck fleet for 14 months. After 60,000 miles, results showed the new fuel produced just half as much smoke as trucks operating with non-detergent fuel. Injector maintenance costs were also reduced.

Diesel operators are all too familiar with gums which collect on plungers, check valves or in spray holes. These sticky substances cause faulty injector action, resulting in fuel waste and loss of power. The new diesel fuel removes these harmful materials as soon as they form. The rust protection feature is important for injectors which see intermittent use. Without the detergent fuel, when diesels lie dormant moisture from condensation accumulates in tanks and injectors causing rust.

Significant factor—the new detergent-action fuel bears no price premium. It is now available at usual rates at Standard bulk plants and truck service stations throughout the West.

APPLICATION ENGINEER

Prominent Midwest manufacturer offers excellent growth opportunity in internal combustion engine application engineering. Will handle all application engineering required by engine contracts. We require three years minimum engineering experience related to fluid flow and design of cooling water, lubricating and fuel oil, and air piping in power plants. Must have ability to calculate size of auxiliary pumps, coolers, etc., and have some knowledge of machine design and engineering mathematics. Salary open. Reply fully in complete confidence, Box K-1157, Diesel Power, 80 Lincoln Ave., Stamford, Conn.

FREE FORM FOR Further FACTS

If you would like further information on subjects advertised, new products described or new literature offered

or

if you would like to have us locate information on products or services not currently appearing in

diesel power

you have only to indicate your requests on these postage free post cards

our reader service department will do the rest

void after December 15, 1957
(In U. S. Only)

Please rush me further information on the following products

_____

_____

described on pages _____ - _____ - _____ - _____ - _____

NAME _____

COMPANY _____ POSITION _____

ADDRESS _____

☐ please have a salesman call

No Postage Stamp Necessary if Mailed in the United States

BUSINESS REPLY CARD

First Class Permit No. 438, Sec. 34.9, P. L. & R., Stamford, Conn.

DIESEL PUBLICATIONS, INC.

80 LINCOLN AVENUE

STAMFORD, CONNECTICUT

Postage Will be Paid by Addressee

Postage Will be Paid by Addressee

BUSINESS REPLY CARD

First Class Permit No. 838, Sec. 34.9, P. L. & R., Stamford, Conn.

DIESEL PUBLICATIONS, INC.
80 LINCOLN AVENUE
STAMFORD, CONNECTICUT

No Postage Stamp Necessary if Mailed in the United States

I DON'T WANT TO MISS A SINGLE ISSUE

Please enter immediately my subscription to DIESEL POWER.

☐ 1 year at $4.00
☐ 2 years at $7.00

☐ I enclose $..... ☐ Bill me later

NAME (PLEASE PRINT CLEARLY)

TITLE

FIRM

STREET ADDRESS
☐ This is my home address ☐ office address

CITY ZONE STATE

DIESEL POWER
80 Lincoln Ave.
Stamford, Conn.

HAVE DIESEL POWER SENT TO YOUR HOME

—read it at your leisure . . . but indicate your title and company as we need this information for our files even if copies are sent home.

Are You Reading YOUR OWN PERSONAL COPY of Diesel Power?

• • • • or is this a pass-along copy . . . with pages clipped out . . . months late . . . . dog-eared?

DON'T MISS OUT on new developments — new techniques — new ideas for getting greater efficiency, cutting your costs . . . in every issue of DIESEL POWER.

GET YOUR OWN COPY EVERY MONTH—have it sent home where you can read it at your leisure . . . it costs so little—JUST 1¼¢ A DAY!

◀ ◀ ◀ ***MAIL THIS HANDY CARD TODAY — to start DIESEL POWER on its way to you.***

SEND NO MONEY NOW-
we'll be glad to bill you later

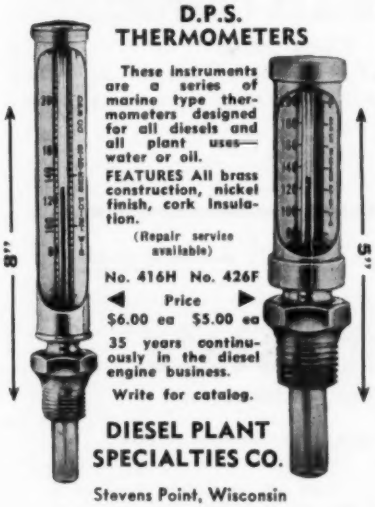
DIESEL INJECTORS
GMC 71
REPLACEMENT PARTS
HIGHEST QUALITY — LOWEST PRICES

Plunger & Bushings	Spacers
Valve Springs	Valve Cages
Valve Stops	Valve Kits
Check Valves	Tip Kits
Injector Valves	Conversion Kits
Spray Tips	Valve Seats

We build special fuel pumps and nozzle parts for all diesels. Order from your distributor—or write us direct.
We have a few available territories open for distribution.

ALLYN MANUFACTURING CO.
1758 W. Wellington Ave.
Chicago 13, Illinois
GRaceland 7-2346

D.P.S. THERMOMETERS



These instruments are a series of marine type thermometers designed for all diesels and all plant uses—water or oil.
FEATURES All brass construction, nickel finish, cork insulation.
(Repair service available)

No. 416H	No. 426F
Price	
$6.00 ea	$5.00 ea

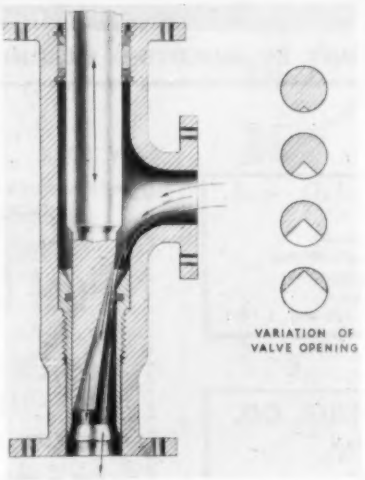
35 years continuously in the diesel engine business.
Write for catalog.

DIESEL PLANT SPECIALTIES CO.
Stevens Point, Wisconsin

THE VERY FINEST
PLUNGER
AND
BUSHING
YOUR ENGINE CAN USE!
Precision Built for GM "71" Injectors
Low Valve: 60, 70, 80, & 90 mm
High Valve: 60, 70, & 80 mm

DIESEL PARTS CO. OF CALIF.
SACO 1800 East 12th Street
Oakland 6, California

new products



New Valve for Fuel Flow Control

General-American Valve Co. introduces a tapered orifice valve for accurate control of fuel flow without clogging. By concentrating all of the flow area in one triangular section instead of around a ring, it is virtually clog-proof.

Flow of fluid is controlled by moving a plug with a tapered slot in and out of a circular opening. A circular sealing ring eliminates by-pass. This tapered orifice valve will pass foreign articles up to 25 times larger than comparable needle valves, it is stated.

Other advantages listed by the maker are: accurate, infinitely variable control, non-freezing, abrasion-resistance and good coefficient of flow at all settings with low turbulence.

For Quick Starts

Sure Fire is a motor starting fluid for gasoline and diesel engines made by Wilco Company. Packaged in pressurized cans, it will operate down to 65° below zero for fast starts.

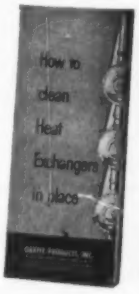
This improved formula with low ether content gives smooth positive starts without detonation, it is reported. It contains a built-in lubricant which lubricates upper cylinder area during initial starting period. It also has a corrosion inhibitor for protection of the cylinder.

How to Clean Heat Exchangers FAST

No need for resorting to laborious disassembling and hand-cleaning when your heat-exchangers become clogged. Now, you can clean them *in place* the modern Oakite way by merely circulating a solution of specialized Oakite detergent through the tubes and shell! The soil is *chemically* removed—faster and more economically than any old-fashioned hand method. Check these other advantages:

- ★ Thorough soil removal
- ★ Cleaning action reaches all areas
- ★ Less wear and tear on units
- ★ Reduces unit down-time
- ★ Makes man-hours more productive
- ★ Reduces consumption of fuel and cooling water

Your local Oakite Technical Service Representative will be glad to give you more details. Call him today—or send for your FREE copy of illustrated pamphlet F9442. There's no obligation. Write Oakite Products, Inc., 22C Rector Street, New York 6, N. Y.



SPECIALIZED INDUSTRIAL CLEANING
OAKITE
MATERIALS • METHODS • SERVICE

Technical Service Representatives in Principal Cities of U. S. and Canada

FUEL INJECTION SALES & SERVICE

SAVE TIME AND MONEY BY EMPLOYING FUEL INJECTION SPECIALISTS

FLORIDA

MIAMI — IN FLORIDA
FLORIDA DIESEL & ELECTRIC CO.
Authorized Service American Bosch
Bendix-Scintilla Roosa-Master
Service & parts for IHC-Caterpillar
GMC—Complete governor service
1930 N. Miami Ave. Phone FRanklin 1-7691

MARYLAND

MECHANICAL ENGINEERING CO.
DIESEL FUEL INJECTION
PUMPS — GOVERNORS
SALES — SERVICE
AMERICAN BOSCH ROOSA MASTER
EXCELLO, G-M, MURPHY, I-H
DEMCO BENDIX ATLAS
PIERCE GOVERNORS IN STOCK
24 HOUR SERVICE
TUXEDO 9-7607
REPAIR SERVICE
2200 SHERWOOD AVE.
BALTIMORE 18, MD.

MASSACHUSETTS

NEW ENGLAND SERVICE
W. J. CONNELL CO.
Diesel Fuel Injection and Governor Service
Newton Industrial Center
BOSTON, 64
DEcatur 2-3630
Airport Road
HARTFORD, CONN.
Tel. 5-3403

MICHIGAN

Authorized
American Bosch Sales & Service
Parts & Service Available on all types
PENINSULAR ENGINEERING & SALES CO.
2424 28th St. S.E.
Grand Rapids, Mich.
Phone
GLendale 2-1548

MISSOURI

DIESEL FUEL INJECTION SERVICE CO.
9331 S. Broadway, St. Louis 23, Missouri Phone: Vernon 2-2121
DISTRIBUTORS OF DIESEL & GASOLINE INJECTION EQUIPMENT
We service and stock parts for:
American Bosch, Bendix Scintilla, Adeco Products, Demco, Cooper-Bessemer, Fairbanks Morse O.P., Caterpillar Nozzles, Cummins Nozzles, G.M. 71 and 110, G.M. 567-278-268, Roosa Master, Woodward Governors, Pierce & Handy Governors, Meteor Gasoline Injector.

NORTH CAROLINA

DIESEL INJECTION SALES & SERVICE
fully equipped to service
American Bosch, Bendix Scintilla, Caterpillar, Cummins,
I-H and Roosa-Master and fuel systems
Pierce, Marquette & Woodward governors
3015 HILLSBORO STREET RALEIGH, N. C.

NEW YORK

UNEX
Fuel Injection Equipment
FOR
- PERFECTLY INTERCHANGEABLE
- 100% GUARANTEED

- G.M.C.
- I.H.C.
- CATERPILLAR
- CUMMINS
- BOSCH

UNEX PRODUCTS CORPORATION
Circle 5-7100
1841 BROADWAY at Columbus Circle N.Y. 23, N.Y.

OHIO

America's Largest GM *fuel injector rebuilder*
Interstate
diesel service incorporated
2093 East 19th Street • Cleveland 15, Ohio
Products sold exclusively through dealer and distributor organizations throughout the United States and Canada. Dealer inquiries welcome

OKLAHOMA

MAGNETO IGNITION COMPANY, INC.
TULSA, OKLAHOMA
Authorized Service and Sales
American Bosch — Scintilla — Roosa Master Pump
701 West 5th
PH-2-8197

TEXAS

BEARD and STONE
FUEL INJECTION — ELECTRICAL — CARBURETOR
AND MAGNETO SERVICE
Houston - Dallas - Texas

Service Section

Cummins—Slow Shut-Down *(Continued from Page 55)*

By performing the three steps described above in the order shown, you will be able to find faulty injectors which otherwise might require considerable time to detect.

Improved Primary Pump On IH

An improved primary pump unit, 275 400 R91 is available for all international Harvester "B" twin-plunger fuel injection pumps. This unit is an increased capacity pump which provides the necessary capacity to charge the plunger cavities without excessive pressure drop. The new primary pump will also provide the customer with maximum fuel filter life.

A letter "W" is stamped in the boss on the side of the injection pump to externally identify the wide gears.

These pumps can be used on UD-525 power units with pump serial number 2541 and up; UD-18A power units with pump serial number 4031 and up; TD-18 (182 series) crawler tractors with pump serial number 4032 and up; UD-1091 power units and TD-24 (gear driven) and TD-24 (torque converter) crawler tractors with pump serial number 3055 and up.

These pump serial numbers are merely used to determine the break-off point between old and new primary pumps at the factory. Any customer ordering old primary pump 270 654 R91 for use on twin-plunger injection pumps will receive the new primary pump 275 400 R91.

LOOK for this SIGN

when you need Specialized Service for your engines. It identifies shops of Qualified Members of the ASSOCIATION of DIESEL SPECIALISTS

It symbolizes Know-How, Modern Facilities and Ethics in Sales and Service of FUEL INJECTION EQUIPMENT, GOVERNORS and ALLIED EQUIPMENT. It guarantees—Work performed by FACTORY-TRAINED TECHNICIANS using FACTORY-APPROVED METHODS.

It is your assurance of—
THE BEST IN WORKMANSHIP AND MATERIALS

Look for the MEMBER SHOP in your vicinity—
ONLY THE BEST CAN QUALIFY

ASSOCIATION of DIESEL SPECIALISTS, INC.
For information contact: S. E. Franklin, Secretary
P.O. Box 596, Wilmington, Calif.

STATEMENT OF THE OWNERSHIP, MANAGEMENT AND CIRCULATION REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912. AS AMENDED BY THE ACTS OF MARCH 3, 1933, AND JULY 2, 1946 (Title 39, United States Code, Section 233)

State of Connecticut } ss.
County of Fairfield }

Of DIESEL POWER published monthly at Kutztown, Pennsylvania for October, 1957.

1. The names and addresses of the publisher and editor are: Publisher, G. Renfrew Brighton, 80 Lincoln Avenue, Stamford, Conn., Editor, Brian P. Emerson, 80 Lincoln Avenue, Stamford, Conn.

2. The owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding 1 percent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a partnership or other unincorporated firm, its name and address, as well as that of each individual member, must be given.)
Diesel Publications, Inc., 80 Lincoln Avenue, Stamford, Conn.; Jessie W. Rosencrans, Chappaqua, New York; Dorothy R. Brighton, Chappaqua, New York; George R. Brighton, Chappaqua, New York.

3. The known bondholders, mortgagees, and other security holders owning or holding 1 percent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state).
None.

4. Paragraphs 2 and 3 include, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting; also the statements in the two paragraphs show the affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bonafide owner.

5. The average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the 12 months preceding the date shown above was: (This information is required from daily, weekly, semiweekly, and triweekly newspapers only.)

DIESEL PUBLICATIONS, INC.
G. RENFREW BRIGHTON, Publisher

(Signature of editor, publisher, business manager, or owner)

Sworn to and subscribed before me this 4th day of October, 1957
PAUL GUTHMAN, Notary Public
State of Connecticut No. 12039
Qualified in Fairfield County
Certificate filed with Fairfield County Clerk
Commission expires April 1, 1962

NEW HIGH SPEED ADJUSTABLE CLOSURES,
IN A WIDE VARIETY OF SIZES AND SHAPES, CUT PRODUCTION TIME AND COSTS!

Snap-Tite® or Turn-Tite®
Cam or Lever Action Test Plugs and Seals designed for high production use!

Snap-Tite types for use during processing of machine parts, tubes, molds, castings, tanks and for testing low pressure applications. *Turn-Tite* types for higher pressure applications. Also where restricted clearance prohibits cam action closure. Also types to accommodate pressure line connector. Snap-Tite and Turn-Tite also used as permanent parts of finished products.

Write for catalog
Direct Inquiries to Dept. 29

MOELLER Mfg. Co., Inc.
Industrial Division
2401 DURAND AVE.
RACINE, WIS.

ADVERTISERS' INDEX

AiResearch Industrial Div., Garrett Corp., The 26
Air Maze Corp., The ***
Albertson & Co. ***
Allis-Chalmers Mfg. Co. 2
Allyn Mfg. Co. 75
Aluminum Co. of America ***
American Air Filter Co. 16
American Bosch Div., American Bosch Arma Corp. ***
American M.A.R.C., Inc. 66
Amot Controls Corp. ***
Association of Diesel Specialists 77

Bacharach Industrial Instrument Co., Inc. 66
Beard & Stone 76
Bell Diesel Research 72
Bendix Aviation Corp., Eclipse Div. 67
Bendix Aviation Corp., Scintilla Div. 22
Borg-Warner Corp., Rockford Clutch Div. 68
Briggs Filtration Co., The ***
Brush Aboe Inc., Petter Engine Div. ***
Burgess Manning Company 65

C.A.V. Ltd. 63
Cities Service Oil Co. 19
Clark Equipment Co. ***
Clayton Mfg. Co., Dynamometers Div. ***
Cleveland Hone & Mfg. Co. ***
Clevite Service Div., Cleveland Graphite Bronze Co. ***
Commercial Filters Corp. 9
Connell Co., W. J. 76
Cook, C. Lee Co. 8
Cooper-Bessemer Corp. 21
Cuno Engineering Corp. 72
Curtiss Wright Corp., Utica Bend Div. 12 13

De Laval Steam Turbine Co. ***
Detroit Controls Corporation ***
Detroit Diesel Engine Div., General Motors Corp. 3rd Cover
Diesel Fuel Injection Service Co. 76
Diesel Injection Sales & Service, North Carolina 76
Diesel Parts Co. of California, (SACO) 75
Diesel Plant Specialties 75

Eaton Mfg. Co. ***
Eclipse Div., Bendix Aviation Corp. 67
Electro-Motive Div., General Motors Corp. 24, 25
Engine Life Products Corp. ***
Erie Forge & Steel Co. ***

Fairbanks, Morse & Co. 17
Florida Diesel & Electric Co. 76
Fram Corp. ***
Fulton-Sylphon Div., Robertshaw-Fulton Controls Co. 71

Garrett Corp., The AiResearch Industrial Div. 26
General Motors Corp., Detroit Diesel Engine Div. 3rd Cover
General Motors Corp., Electro-Motive Div. 24, 25
General Motors Corp., Harrison Radiator Div. 7
Gillett & Eaton, Inc. ***
Greenlee Bros. & Co. ***

Harrison Radiator Div., General Motors Corp. 7
Hilliard Corporation, The ***
Houdaille Industries Inc., Manzel Div. ***

Illinois Testing Laboratories, Inc. ***
Ingersoll-Rand Co. 70
International Harvester Co. ***
International Nickel Co. ***
Interstate Diesel Service, Inc. 76

Johnson Bronze Co. ***

Kato Engineering Co. 62
Kiene Diesel Accessories, Inc. 65
Kim Hotstart Mfg. Co. 64
Kittell Muffler & Engineering Inc. ***
Koppers Co., Inc. 14

Luber-Finer, Inc. ***

Magneto Ignition Co., Inc. 76
Manzel Div., Houdaille Industries, Inc. ***
Maschinenbau, Kiel, Aktiengesellschaft (MAK, Kiel, Germany) 10
M.A.N. Maschinenfabrik Augsburg-Nurnberg (A.G. Augsburg, Germany) ***
Maxim Silencer Co. 69
Mechanical Engineering Co. 76
Minneapolis-Honeywell Regulator Co. 4
Moeller Manufacturing Co. 77
Morco, Inc. ***

Napier & Sons, Ltd. ***
National Forge & Ordnance Co. 58
Nordberg Manufacturing Co. 6
Norris, R. S. & Associates ***
Nugent, Wm. W. & Co. ***

Oakite Products, Inc. 75

Pacific Diesel Parts Co. ***
Park Drop Forge Co., The ***
Peninsular Engineering & Sales Co. 76
Perfect Circle Corp. ***
Petter Engine Div., Brush Aboe, Inc. ***
Purolator Products, Inc. 28

Quincy Compressor Co. ***

Robertshaw-Fulton Controls Co., Fulton Sylphon Div. 71
Rockford Clutch Div., Borg-Warner Corp. 68

Schwitzer Corp. ***
Scintilla Div., Bendix Aviation Corp. 22
Sealed Power Corp. 30
Sharples Corp. ***
Shell Oil Co. 11
Snap-On Tools Corp. 61
Spray Products Corp. 70
Standard Oil Co., Inc. (California) 23
Standard Oil Co., Inc. (Indiana) Fourth Cover
Sterling Engine Co., Inc. ***
Sturtevant, P. A. Co., The ***
Synchro-Start Products Corp. ***

Texas Company, The 2nd Cover & 1
Thomas Flexible Coupling Co. ***
Thompson Products, Inc., Jet Div. 15
Tuthill Pump Co. 27
Twin Disc Clutch Co. ***

Unex Products Corp. 76
United Engine & Machine Co. ***

Van Norman Automotive Equipment Co. ***
Vellumoid Co. ***
Viking Pump Co. 62

Waukesha Motor Co. 57
White Diesel Eng. Div., White Motor Co. ***
Wilkening Manufacturing Co. 20
Winona Tool Mfg. Co. 64
Winslow Engineering & Mfg. Co. ***
Woodward Governor Co., Inc. 3
Worthington Corp. ***
Wyman-Gordon Company 18

Young Radiator Company 59

Zollner Corp. ***

GM DETROIT DIESEL PARTS

...factory-engineered for long life, low-cost service

CYLINDER LINER QUALITY CONTROL

In checking the metal's hardness for wear resistance, diameter dimensions are measured electrically as well as mechanically to insure perfect fit and interchangeability. Even the smoothness of the ground liner surface is recorded by this "on-the-production-line" inspection.

MODERN PARTS DEPOTS ALWAYS NEARBY

GM Detroit Diesel Distributors and Dealers from coast to coast carry complete stocks of factory-engineered GM Detroit Diesel parts. They're as near as your telephone—ready "round the clock" to keep your engines working and earning for you.

You're always money ahead when you buy factory-engineered parts from your Distributor or Dealer

GM GENERAL MOTORS DIESEL POWER

DETROIT DIESEL

Engine Division of General Motors

Detroit 28, Michigan

Single Engines . . . 30 to 300 H.P. Multiple Units . . . Up to 893 H.P.

It pays to standardize on GM Diesels

6 *reasons why STANODIESEL Oil M can help you get better diesel engine performance*

Stability. Only selected distilled lubricating stocks from Mid-Continent crudes are used to make STANODIESEL Oil M. Base stocks are then solvent-extracted to remove unstable components. Oil is further stabilized by an oxidation inhibitor. The oxidation inhibitor used also acts as a metal deactivator, forming a barrier against corrosion. As a result of these advanced refining techniques, STANODIESEL Oil M resists the formation of varnish, sludge, acid bodies and carbon-like deposits. Viscosity increase, a problem in many types of service, is likewise controlled.

Detergent-Dispersant Qualities. Additives keep engines clean and disperse contaminants by holding them suspended in harmless form.

High Viscosity Index. STANODIESEL Oil M's high V. I. means easier cold starts, better sealing of rings and lower oil consumption at running temperatures.

Nonfoaming. Antifoamer additive eliminates foaming. STANODIESEL Oil M may be used in hydraulic governors.

Low Pour Point. STANODIESEL Oil M is propane-dewaxed to remove undesirable constituents and permit flow at low temperature.

Less Engine Maintenance. STANODIESEL Oil M helps give these low maintenance benefits: reduced port deposits, fewer stuck rings, less cylinder wear, fewer bearing problems.

STANDARD

STANDARD OIL COMPANY
(Indiana)

Get all the facts about STANODIESEL Oil M from your local Standard Oil industrial lubrication specialist anywhere in the 15 Midwest and Rocky Mountain states. Or write Standard Oil Company, 910 South Michigan Avenue, Chicago 80, Illinois.